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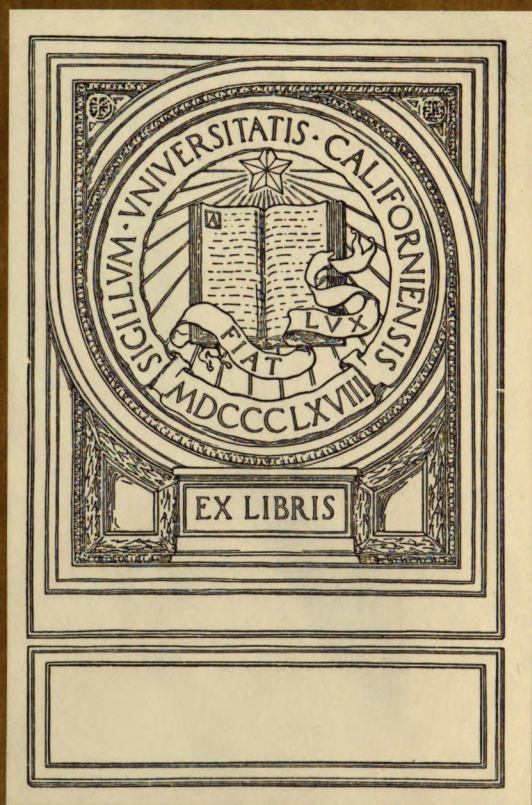
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PROCEEDINGS
OF THE
American Forestry Association



AT THE
Tenth, Eleventh, and Twelfth Annual Meetings,
Washington, December, 1891, 1892, and 1893,
AND AT THE
World's Fair Congress, Chicago, October 18 and 19, 1893.

VOLUME X.

WASHINGTON, D. C.:
1894.

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NOTICE.

The Proceedings of the American Forestry Association have hitherto been published irregularly, the volumes not being numbered. With the improved financial condition of the association, and its greatly increased membership, a regular issue of the annual proceedings in future appears warranted, and it seems desirable to designate, by numbers, not only the coming volumes but also those previously issued. The present volume is, therefore, numbered X. The series of previous volumes includes the following publications :

- Vol. I.—Proceedings of the special meeting at Montreal, August, 1882.
Papers read before the meeting printed separately by the Canadian Government in the Ontario Fruit Growers' Report. (The proceedings of the first annual meeting, that held at Cincinnati, April 25-29, 1882, were not published in pamphlet form.)
- Vol. II.—Proceedings of the second annual meeting, at St. Paul, August, 1883. Also, Forestry Bulletins No. 1 (May, 1884); No. 2 (September, 1884); No. 3 (January, 1885).
- Vol. III.—Proceedings of the special meeting at Washington, D. C., May, 1884, and third annual meeting, at Saratoga, New York, September, 1884.
- Vol. IV.—Proceedings of the fourth annual meeting, held at Boston, September, 1885.
- Vol. V.—Proceedings of the fifth annual meeting, held at Denver, Colorado, September, 1886. (Newspaper report.)
- Vol. VI.—Proceedings of the sixth annual meeting, held in Springfield, Illinois, September, 1887.
- Vol. VII.—Proceedings of the seventh annual meeting, held at Atlanta, Ga., December, 1888, and of the eighth annual meeting, held at Philadelphia, Pa., October, 1889.
- Vol. VIII.—Proceedings of the summer meeting, held in Quebec, September, 1890, and of the ninth annual meeting, held in Washington, D. C., December, 1890.
- Vol. IX.—Papers read at joint session of the American Economic Association and the American Forestry Association, held at Washington, D. C., December, 1890.

The present volume, X, will contain the proceedings at the tenth, eleventh, and twelfth annual meetings, held in 1891, 1892, and 1893, and those of the special meeting at the World's Fair Congress in Chicago in 1893. In order to expedite the long-delayed issue of this publication, it will be printed in separate parts or brochures, with continuous paging, so that the parts can finally be bound into one volume. Copies of former volumes, as far as on hand, can be had at current prices by application to the Secretary. Members receive, besides the publications of the association, the bi-monthly periodical known as "Forest Leaves."

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 Wilmsen, Bernhard, 413 Commerce St., Philadelphia.
 Wolfe, Dr. Samuel, 1624 Diamond St., Philadelphia.
 Wood, Stuart, 400 Chestnut St., Philadelphia.

RHODE ISLAND.

Emmons, Arthur, Newport.
 Mason, Miss Ida M., R. I. Avenue, Newport.
 Russell, H. S., E. Greenwich.

SOUTH CAROLINA.

Green, Prof. H. A., Chester.
 Hemphill, James, Chester.
 Love, Col. R. A., Chester.
 McKie, Dr. Thos. J., Woodlawn.

SOUTH DAKOTA.

Keffer, Prof. Chas. A., Brookings.
 Williams, Prof. Thomas A., Brookings.

TENNESSEE.

Callender, Dr. J. H., Central Hospital for Insane, near Nashville.

TENNESSEE—Continued.

Goulding, B. L., Chamber of Commerce, Chattanooga.
 Roberts, Hon. Albert, Nashville.
 Wright, Col. Thomas T., Nashville.

TEXAS.

Jones, W. Goodrich, Temple National Bank, Temple.
 Moore, J. E., Temple.
 Nunnally, J. B., Temple.

VERMONT.

Battell, Joseph, Middlebury.
 Edmunds, Hon. G. F., Burlington.
 Fuller, Gov. Levi K., Brattleboro.
 Grout, Hon. William W., St. Johnsbury East.
 Proctor, Hon. Redfield, Proctor.

WEST VIRGINIA.

Hopkins, A. D., W. Va. Agricultural Experimental Station, Morgantown.

WASHINGTON.

Meany, Edmund S., Seattle.

WISCONSIN.

Putnam, H. C., Chippewa Valley Bank, Eau Claire.
 Swift, Elijah, Eau Claire.
 Upham, W. H., Marshfield.
 Weyerhauser, Frederick, Mississippi Logging Co., Chippewa Falls.

CANADA.

Allan, Hon. G. W., Toronto, Ontario.
 Boyd, M. M., Bobcageon, Ontario.
 Campbell, Archibald, Quebec.
 Craig, John, Dominion Experiment Farm, Ottawa, Ontario.
 Crown Lands Department, Quebec.
 Crown Lands Department, Treasury Department, Toronto, Ontario.
 *Denton, Jno. M., London, Ontario.
 *Drummond, A. T., Montreal.
 *Joly, Hon. H. G., Le Clereville, Quebec.
 Little, Wm., Montreal.
 Perley, George H., Ottawa, Ontario.
 Price, Herbert N., Quebec.
 Robitaille, Hon. L. A., Box 542, Quebec.
 Ross, Hon. David A., Quebec.
 *Russell, A. J., Ottawa.
 Saunders, Wm., Central Experimental Farm, Ottawa.
 *Shanley, Walter, Montreal.
 Turner, Richard, Quebec.

CONSTITUTION

OF THE

AMERICAN FORESTRY ASSOCIATION.

ARTICLE 1. This association shall be known as the American Forestry Association.

ARTICLE 2. The objects of this association shall be the discussion of subjects relating to tree-planting, the conservation, management, and renewal of forests, and the climatic and other influences that affect their welfare; the collection of forest statistics; and the advancement of educational, legislative, or other measures tending to the promotion of these objects. It shall especially endeavor to centralize the work done, and diffuse the knowledge gained.

ARTICLE 3. Any person may become a member of this association, subject to approval by the executive committee, by the payment of the annual dues. The annual dues shall be two dollars. Any member may become, by the payment of fifty dollars at one time, a life member, and shall not be liable thereafter to annual dues. Any person contributing one hundred dollars to the permanent fund of the association shall be a Patron.

ARTICLE 4. The officers of this association, to be elected at the annual meeting, shall be a president, one vice-president for each state, territory, and province represented in the association, a treasurer, a recording secretary, a corresponding secretary, and six other persons to serve on the executive committee. The executive committee shall consist of the president, the vice-president for the District of Columbia, the treasurer, the two secretaries together with the six persons above designated. Three of this committee shall constitute a quorum. This committee shall choose its own chairman.

ARTICLE 5. The president shall preside at all meetings of the association in general session, and in his absence a vice-president shall preside.

ARTICLE 6. The recording secretary shall keep a record of the proceedings of the association, and shall be custodian of all documents, books, and collections ordered to be preserved.

ARTICLE 7. The corresponding secretary shall conduct the correspondence of the association.

ARTICLE 8. The treasurer shall have charge of all funds, and pay out the same on the direction of the executive committee.

ARTICLE 9. The association at any regular meeting, or its executive committee in the intervals between its meetings, may appoint such local or special committees as may be deemed proper, and shall define their duties.

ARTICLE 10. The annual meeting of the association shall be in the months of August, September, or October, or at such times and places as shall be determined by a vote in general session or by the executive committee. Special meetings may be called by the executive committee.

ARTICLE 11. At each annual meeting there shall be an election of officers for the ensuing year, and they shall remain in office until others are chosen. In cases of vacancies occurring in the intervals between the annual meetings, they may be filled by the executive committee until others are selected. In case of absence of an officer at a regular meeting his place may be deemed vacant.

ARTICLE 12. The officers of states, territories, provinces, or local forestry associations, or their delegates, or the delegates of any Government, may participate in the proceedings of the association as honorary members.

ARTICLE 13. This constitution may be amended by a two-thirds vote of the members present at any annual meeting.

BY-LAWS.

1. Papers or abstracts of papers to be read must be sent two weeks before any meeting, for classification, to the corresponding secretary.

2. The following classification of subjects is adopted for the reading of papers:

Section A. Forest planting, forest management, forestry proper, preservation of forests.

Section B. Forest economy, technology and statistics.

Section C. Applied science and climatology, general topics.

3. Contributors who are present shall have the preference in reading their papers.

4. Any member shall be entitled to the privilege of using any books or documents, not of record, at the discretion of the recording secretary.

Tenth Annual Meeting.

1891.

The tenth annual meeting of the association was held at Washington, D. C., December 29, 1891. In the absence of President Alvord, Hon. Edwin Willits, Assistant Secretary of Agriculture and one of the vice-presidents, took the chair as presiding officer and called the association to order.

After the reading of the minutes of the last meeting by the recording secretary, the corresponding secretary read his report. From this it appeared that three members of the association had died during the last year and that 43 new members had been added to the roll of membership. The report also announced a very marked and encouraging degree of interest in forestry in several of the Western States.

The report of the treasurer showed the receipt of \$589.53 during the year, applicable to current expenses, and a payment of \$409.69, leaving a balance in the treasury of \$179.84 for current expenses. The permanent fund was also increased by \$250, making the fund now \$812.87.

The report of the committee on Arbor Day showed evidence of a growing interest in the observance of this day all over the country. It is established now in distant Oregon and North Dakota. In New York, which has been tardy in establishing Arbor Day, it has been adopted with great enthusiasm, and important results are already manifest in connection with the public schools. It has become an important co-efficient in village improvement. The observance of the day has become a patriotic feature, especially in those Southern States which have fixed its date on Washington's birthday. The custom of planting memorial trees in honor of Washington, Lincoln, Grant, and other patriots has become general.

The results of Arbor-Day tree-planting in an economic point of view are even marvellous. In the twenty years since the origin of the day in Nebraska it is reported on good authority that more than 35,000,000,000 trees have been planted in that State.

The executive committee reported that its attention had been principally directed during the year to securing a liberal applica-

tion of the law of March 3, 1891, which, in section 24, authorizes the President of the United States to reserve woodlands, and also makes other provisions of the highest importance to the future of the public timber lands.

The law provides that the President may, by proclamation, from time to time, set aside any portions of the public woodlands as public reservations. At the same time, cutting off timber on the public timber lands is permitted in several of the States and Territories, if for use within the same by residents thereof, the regulation of such cutting being under the direction of the Secretary of the Interior; but the pleading that the cutting of the timber had been for domestic, mining, or manufacturing purposes shall be a defence in cases of trespass. The natural effect of this permission will be to stimulate the cutting of timber on the public lands thus thrown open to every one, with the probability that roving and irresponsible lumbermen will cut the best and deprive the permanent and law-abiding citizens of their just share in the forest resources.

Nothing can prevent this result but a wise and just system of management of the public lands, scrupulously protecting the rights of all and rigorously and impartially enforced. The proclamation of reserves by the President will be of little public benefit without such a system of management accompanying it. The Secretary of the Interior, with gratifying forethought, has endeavored to place an administrative check upon the wrongful appropriation of the public timber, by requiring a permit for cutting to be obtained from the General Land Office at Washington; but it is to be feared that this will be inadequate to prevent the evil results anticipated, especially as no local supervision can be provided for under existing appropriations.

Your committee, then, wishes to express emphatically its position regarding the proposed reservations and their management.

(1) Reservations in detached localities, while perhaps preferable to none, will not satisfy the needs of forest protection unless their number is sufficiently large to embrace practically all remaining public woodlands.

(2) The all-important problem is that of the management of these reservations made, or to be made. This should be solved at once and simultaneously with the making of the reservation.

(3) The principles upon which such management must proceed are laid down in a draft of suggestions for a bill, submitted here-

with by the committee, in which safeguards are provided to protect prior rights; the return of agricultural lands to entry; licenses to prospect for minerals, to camp, hunt, fish, and otherwise use the reservations legitimately; licenses to cut timber under regulations adapted to the necessities of the locality; protection against fire and theft, and 'such organization as will secure, with the co-operation of State authorities, the objects of the reservations, and at the same time offer as little friction as possible to existing conditions.

Interesting reports were then made by members and delegates in regard to the forest interests in their respective States, and the usual committees were appointed.

The afternoon session was devoted to the discussion of the subject presented by the report of the executive committee, and the consideration of the draft of a public bill designed to carry out the suggestions of the committee.

The Hon. J. W. Noble, Secretary of the Interior, addressed the association at length, expressing hearty sympathy with its aims, his readiness to receive suggestions in regard to the management of the timber lands, and his willingness to do all in his power to aid the association in its work.

The thanks of the association were given to Secretary Noble for his encouraging words.

The address of Secretary Noble was followed by a paper prepared by the Hon. Thos. H. Carter, Commissioner of the General Land Office. The object of the paper was to set forth the present attitude of the Government towards the objects of the association.

The association was next addressed by the Hon. Senator H. L. Dawes, who spoke at considerable length and in hearty commendation of the objects and work of the association. He spoke of the difficulties attendant upon the enforcement of law as being not less than those to be met in securing its enactment, and said that the ingenuity of the law-maker had never yet been equal to the ingenuity of the spoliator. He spoke of the power of public sentiment, and said: "You must get behind Congress and make Congressmen feel that behind them is a public sentiment that will demand that the spoliators shall not only take their hands off, but that the Government shall, so far as it is in its power, restore what has been lost."

The remainder of the session was occupied with the discussion of a series of questions, prepared by the executive committee, in regard to the establishment and management of the proposed

reservations. The first questions presented were, "What should be the extent or number of reservations, and what their character?" "What methods should be adopted for the purpose of avoiding interference with other interests and opposition to the establishment of the reservations?" "Shall the reserved lands be ceded as such to the individual States or remain, at least for the present, in possession of the General Government?"

In regard to these questions the views of the executive committee were given briefly, concluding with the statement that the wisest and most desirable result would be to have all the remaining public timber lands reserved. In the discussion that followed there was a general agreement of opinion that it would not be wise to cede the timber lands to the States, but that they should remain under the management of the General Government.

The next question presented for discussion was, "Shall the management of the public timber lands be carried on as a part of the business of the General Land Office, by a separate bureau of the Department of the Interior, by a bureau of the Department of Agriculture, or by an independent bureau?" The conclusion of the executive committee was stated to be, after much study of the subject, that the best course would be to place the management of the reservations under the control of a new division of the Department of the Interior. The association seemed to acquiesce in this opinion, and passed on to consider the question, "What regulations are necessary and desirable, *first*, to prevent fire; *second*, to regulate occupancy; *third*, to regulate the cutting of timber, and, *fourth*, for general administration?" The entire afternoon having been spent in this discussion, other questions, as to the qualification of officers for the administration of the reserves, and the methods to be adopted for securing State co-operation, were left without consideration, and the association adjourned to Wednesday, at the office of the Experiment Stations, Department of Agriculture.

WEDNESDAY, DECEMBER 30, 1891.

The association met at 10 o'clock, vice-president Northrop in the chair.

The committee on nominations and resolutions reported. They nominated for election the officers of last year, with a few exceptions only, viz: Mr. J. O. Barrett, of Minneapolis, as vice-president for Minnesota; Hon. Warren Higley, for New York; Hon. Albert

Roberts, of Nashville, for Tennessee, and Hon. George F. Edmunds, of Burlington, for Vermont; adding to the list of vice-presidents Hon. W. W. Barrett, of North Dakota.

Prof. Cleveland Abbe, of Washington, was proposed as a member of the executive committee in place of C. C. Binney, and J. Grant Wilson, of New York, as an additional member.

It was recommended that the duties of publication be transferred to the executive committee, and that this committee have the power of filling vacancies.

The report was accepted, the recommendations contained therein were adopted, and the officers nominated were duly elected.

The committee on finance and permanent secretary reported that it was desirable that an effort be made immediately to raise the sum of two thousand dollars for the purpose of employing a salaried secretary or agent, and suggested a method by which to secure this sum. The report was adopted.

Mr. Bowers read a memorial which had been prepared by the executive committee for presentation to President Harrison. It was accepted and ordered to be signed by the executive committee on behalf of the association.

The association then adjourned for the purpose of meeting the President and to reconvene at 2 o'clock at the National Museum.

WEDNESDAY AFTERNOON.

The association met according to adjournment, vice-president Willits in the chair.

The committee on resolutions offered its report as follows :

RESOLUTIONS.

Resolved, 1. That the thanks of the American Forestry Association be extended to the Secretary of the Interior, Hon. John W. Noble, for his presence at our meeting of December 29, and for the earnest expression of a desire to co-operate with the objects of our association.

2. This association expresses its opinion that the opposition to the establishment of public timber reservations arises either from misconception as to their objects and the manner of their management, or as the result of the effort of individuals for their private gain without regard to public welfare.

3. The association respectfully submits to the Secretary of the

Interior that he use the authority granted to him by law, and that he withdraw from settlement and entry temporarily, during examination, all tracts of land recommended for reservations by this association.

4. This association urges upon the superintendents of the public schools in the several States to require that the high schools shall make forestry, in connection with botany, a subject of instruction.

5. WHEREAS, This association holds that the interests of agriculture are ultimately dependent upon a proper forest condition; and

WHEREAS, The Government of the United States has recently made large additional appropriations to the agricultural colleges and experiment stations:

Resolved, That this association earnestly recommends that forestry be made a part in the curriculum of all agricultural colleges and of the experimental work by the various stations where this is not already done.

The resolutions were unanimously adopted.

The association then took up the regular order of business, the hearing and discussion of papers prepared for the occasion by the arrangement of the executive committee.

The first paper read was by Mr. Gifford Pinchot, on "The Development of a Protective Forest Policy in Europe."

The second paper was by Mr. J. D. W. French, on "The Forestry Movement in the United States."

This was followed by a paper from President C. K. Adams, of Cornell University, on "The needs of Forestry Education in the United States."

The reading of these papers was followed by remarks from Judge Higley, of New York; Rev. J. P. Lundy, of Philadelphia; Ex-Governor Hoyt, of Wyoming, and others.

The last paper read was by Mr. B. E. Fernow, on "The Proper Administration of Forest Reserves." The reading of these papers and the accompanying addresses occupied the entire afternoon.

Owing to the lateness of the hour, the usual reading of minutes was dispensed with. The publication of the proceedings was referred to the executive committee, and at 5 o'clock the association adjourned *sine die*.

N. H. EGGLESTON,
Secretary.

The association having been prevented from presenting its memorial in behalf of forest reservations to the President on Wednesday, those members of the association who had not left the city assembled at the Executive Mansion, on Thursday, at 10 o'clock. They were individually presented to the President, and Judge Higley explained the objects of the memorial and expressed the grateful feelings of the association for the interest already manifested by the President in its work. The President received the members very kindly and assured them of his sympathy with their efforts and his disposition to do all in his power to favor and co-operate with their endeavors.

Eleventh Annual Meeting.

1892.

The association met at the Department of Agriculture, in Washington, D. C., at 10 o'clock, December 20, 1892.

Hon. Edwin Willits, one of the vice-presidents, took the chair in the absence of president Alvord.

The minutes of the last meeting were read and approved.

The reports of the secretaries and of the treasurer were read and accepted. From the latter it appeared that there was a balance on hand to the credit of the current expense fund of \$362.13, and a balance to the credit of the permanent fund of \$933.36.

The report of the Arbor Day committee was read and accepted. The report stated that in no previous year had so many schools been engaged in the observance of Arbor Day. Among the most cheering signs of progress was the recent action of the American Educational Association, recommending the universal observance of the day, and the establishment of village and district improvement associations, and the planting of memorial trees.

Discussion followed, and the committee was urged to present at the next annual meeting a list of trees most suitable for street planting, with the proper method of planting and trimming the same.

The report of the executive committee was read and accepted, and after the discussion of the subjects presented by it, they were referred to the executive committee for further consideration and such action as might be deemed advisable.

Arrangements having been made with the Secretary of the Interior for a conference in regard to making additional reservations of the public timber lands, and with the Public Lands Committee of the House of Representatives, Messrs. Little, French, Fernow, Bowers, Pellew, Jones, and Eggleston were appointed a committee for this purpose.

At the afternoon session the committee on nominations reported a list of officers for the ensuing year. The report was accepted and the persons nominated were appointed. Nine new members of the association were elected at the same time.

A minute in regard to the death of Dr. J. P. Lundy, one of the most devoted members of the association, was adopted, and the secretary was directed to transmit a copy of it to Mrs. Lundy as an expression of sympathy.

The publication of proceedings and reports, the legal incorporation of the association, and all other business matters were referred to the executive committee, and the association then adjourned *sine die*.

N. H. EGGLESTON,
Secretary.

Special Meeting at Chicago.

1893.

A special meeting of the Association was held at Chicago on the 18th and 19th of October, 1893, in connection with the World's Fair Congress Auxiliary.

In the absence of the president, Hon. J. Sterling Morton, Mr. Fernow called the meeting to order and occupied the time which had been assigned for the president's opening address by reading a paper on the "Conditions and Problems of the Forestry Movement in the United States." This paper was followed by an address by Hon. John W. Noble, late Secretary of the Interior, on "Our National Parks and Timber Reservations—their Importance and proper Administration."

Mr. Noble was followed by Prof. William Saunders, of Ontario, Director of the Experimental Farms of Canada, who read a paper on "Forest Conditions on the Plains and Prairies of Canada."

Mr. Aubrey White, Commissioner of Crown Lands in the Province of Canada, then addressed the association in regard to "The Forest Resources of Canada and the Management of the Government Timber Lands."

At the conclusion of Mr. White's address, Mr. Henry L. de Vilmorin, of France, was introduced, who spoke of the selection of seeds for forestry purposes.

At the afternoon session of Wednesday, Mr. J. S. Hobbs, of Maine, read a paper on the forest condition of that State.

Col. Wm. F. Fox, State Superintendent of Forests, read a paper on the forestry conditions of New York.

The next paper read was by Prof. J. T. Rothrock, Forest Commissioner, on the forestry problem in Pennsylvania.

Mr. C. H. Putnam, of Wisconsin, read a paper on the forest condition of the northwestern lumber States.

Mr. W. N. Byers made a brief statement in regard to forest conditions in Colorado.

At the close of the Wednesday session a committee on resolutions was appointed, consisting of Messrs. Hobbs, French, Fox, Bowers, and Ensign.

THURSDAY, OCTOBER 19, 1893.

At the opening of the session a paper was read by Dr. Gustave Niederlein, Argentine Commissioner to the World's Fair, on the forests of the Argentine Republic.

Mr. William Little, of Montreal, next made an address on the forest resources of Canada. He was followed by Mr. E. F. Hobart, Surveyor-General of New Mexico, who read a paper on the forest conditions and needs of the Southwestern Territories.

Mr. W. R. Dobbin then made a report on the work of the Minnesota Forestry Association and the importance of a forest reservation in that State. Mr. J. O. Barrett, State Forest Commissioner, also spoke briefly on the same subject.

Mr. M. L. Saley, editor of the *Northwestern Lumberman*, then presented a paper on "The relation of Forestry to the Lumbering Industry."

A paper on "The relation of Forestry to Lumbering and the Woodworking Industries" was then read by Mr. J. E. Defebaugh, editor of the *Timberman*.

Mr. Gifford Pinchot then made a brief address on the mutual interests of the lumberman and the forester.

Mr. Fernow occupied the remainder of the morning session with a paper on "Timber as a Crop."

THURSDAY AFTERNOON.

The first part of the afternoon session was devoted to matters of business. The selection of the time and place of the next annual meeting was referred to the executive committee.

The committee on resolutions, to whom was referred the resolution of Mr. Hobbs in regard to the exemption of timber lands from taxation, reported the same favorably. After full discussion and some amendments, the resolution was adopted as follows:

Resolved, That the governors of the States of this Union be respectfully requested to recommend legislation in accordance with the following propositions:

First. That the increased value of land arising from the planting of trees, where none were growing, may be exempt from taxation until some profit shall be realized from the plantation.

Secondly. That land covered with tree-growth reserved for farm uses and connected with a farm shall, for the purposes of taxation, be taken at no higher value than if it were without such growth.

The first paper read at this session was by Hon. Warren Higley, on the "Aims and Accomplishments of the American Forestry Association."

Mr. B. S. Hoxie gave an account of the forestry condition of Wisconsin.

Hon. B. G. Northrop read a brief paper on Arbor Day.

The last paper read was by Col. E. T. Ensign, on the "Forest Reserves of the Western Mountain Region."

The committee on resolutions reported the following, which, after some remarks by Mr. Edw. A. Bowers, was unanimously adopted:

Resolved, That it is the sense of this Congress that the policy inaugurated by the United States government of establishing forest reservations on the public domain should be maintained and extended, and that a proper administration of the same, looking to their rational use and protection, is an urgent necessity.

After further remarks by Mr. Bowers, setting forth the legislative action which has been taken in regard to the public timber lands, and what further action was, in his opinion, necessary, the body adjourned *sine die*.

A large number of papers which had been prepared were not read, for want of time. Among them were the following: Forestry in New South Wales, by Robert Hudson, General Superintendent of the New South Wales Exhibit at the World's Centennial Exposition; Condition of Forestry in California, by Abbot Kinney; Forest Administration, State or Federal, by George H. Parsons, of Colorado; Forest Conditions and Forest Problems of Venezuela, by A. Ernst; How May Forestry Interests be Advanced, by Herbert Welsh; Relation of the State to its Forestry, by Hon. J. B. Walker, of New Hampshire; Duty of the Government to Establish Timber Reserves in the Pacific Coast Forests, by E. W. Hammond, of Oregon; Relation of Forest Cover to Waterflow, by Prof. M. C. Read, of Ohio; Relation of Railroads to Forestry, by Howard Miller, Esq.; Forestry Legislation of the States and Territories, by C. C. Closson, Jr., of Massachusetts; Forest Interests and the American Mind, by J. B. Harrison, of New Hampshire; Forest Conditions in the Gulf States, by Charles Mohr, of Alabama; Forest Legislation in Europe, by J. D. Jones, District of Columbia; Forests and Health, by Prof. Cleveland Abbe.

N. H. EGGLESTON,

Secretary.

Twelfth Annual Meeting.

1893.

The twelfth annual meeting of the Association was held at Washington, December 15, 1893. In the absence of president Morton, vice-president Willits presided.

The minutes of the last annual meeting and those of the special meeting at Chicago, held in connection with the World's Fair Auxiliary, were read and approved.

A partial report of the Arbor Day Committee was made by Mr. Eggleston, and it was voted that the committee be continued in office, and that the subject referred to it last year be recommitted to be reported upon at the next annual meeting.

The report of the executive committee was presented by Mr. Fernow. It was accepted and laid upon the table temporarily, with the view of subsequently discussing the matters suggested for consideration by the report.

The secretary made a brief verbal report and referred to the report of the executive committee as embodying his views and showing his work for the past year.

Messrs. Bowers, Stiles, Binney, Newell, and Abbe were appointed as a committee for the nomination of officers and the consideration of amendments to the constitution.

Letters from absent members regretting their inability to attend the meeting were read.

The report of the executive committee being taken up for consideration, the recommendation of the committee that a special meeting of the association, on the invitation of the State Forest Commission of New York, be held at Albany was discussed.

Messrs. Weed, Fox, and Tweedy, officers of the commission, were present, and offered considerations showing the importance of such a meeting to the forestry interests of New York as an aid in securing desirable legislation for the establishment and management of the Adirondack Park.

The recommendation of the executive committee was adopted, and the committee was empowered to make arrangements for the proposed special meeting.

The recommendation of the committee for the publication of the papers read at the special Chicago meeting, or a selection from them, was adopted, and it was voted to appoint a special committee of publication for this purpose.

Mr. Bowers reported his action in regard to the incorporation of the association, and it was voted to take steps as soon as possible to secure such incorporation.

The treasurer's report was read and referred to Messrs. Jones, Elwin, and Fox as an auditing committee. This committee subsequently reported that the accounts of the treasurer were in a satisfactory condition, and was discharged.

The treasurer was authorized, after writing to members delinquent in the payment of their annual dues for the space of two years, to drop them from the list of members.

At the afternoon session papers from Messrs. H. C. Putnam, Abbot Kinney, and others were read. The papers and the subjects involved were referred to the executive committee for their disposal.

Messrs. Fernow, Bowers, and Fox were appointed a committee on resolutions.

The following persons were proposed for membership and were elected:

Messrs. Wm. R. Weed, of Potsdam, N. Y.; C. O. McCreedy, Ballston Spa, N. Y.; Geo. H. Moses, Concord, N. H.; Hon. Wm. E. Chandler, Concord, N. H.; Hon. Redfield Proctor, Proctor, Vermont; Hon. Chas. W. Dabney, Jr., Assistant Secretary of Agriculture; H. S. Russell, E. Greenwich, R. I.; Philip Codman, Brookline, Mass.; C. C. Closson, Lawrence, Mass.

The committee on nomination of officers made a report, and the persons nominated to the respective offices were chosen.

Mr. French expressing his inability to serve as secretary another year, he was, notwithstanding, chosen secretary *pro tem.*, and the executive committee was empowered to elect a permanent secretary, as it should seem desirable and practicable.

An amendment of the constitution was adopted making the executive committee to consist of the president, the vice-president, from the District of Columbia, the secretaries, the treasurer, and six other members of the association.

It was voted to hold the next annual meeting at Washington.

In view of some misrepresentations of the forestry bill—known as the McRae bill, now before Congress, the association referred the subject of its endorsement to the committee on resolutions.

The association sanctioned and approved the action of the executive committee during the last year.

The importance of having a paid secretary who could devote his whole time to the service of the association was considered, and, after discussion, was referred to the executive committee.

A vote of thanks was given to the chairman for his interest in the work of the association and his kindness in presiding at our meetings, after which the association adjourned *sine die*.

N. H. EGGLESTON,
Secretary.

MEETING

Held in Chicago, Illinois, October 18 and 19, 1893,

IN CONNECTION WITH

The World's Congress Auxiliary of the World's Columbian
Exposition.

WEDNESDAY, OCTOBER 18, 1893.

The Forestry Congress assembled in room 22 of the Art Institute at 10 o'clock in the morning, Mr. B. E. Fernow, chairman of the committee of arrangements, in the absence of the president of the association, presiding.

After a few introductory remarks on the history, objects, and scope of the present meeting, the chairman read the following paper as an introduction to the subject, which he said would occupy the largest share of the attention of this Congress.

FOREST CONDITIONS AND FORESTRY PROBLEMS IN THE UNITED STATES.

By B. E. FERNOW.

The United States in historic times were not as well wooded as many other countries. Forest growth never covered as much as 60 per cent. of the vast areas stretching across the continent from the Atlantic to the Pacific Ocean; and yet the impression of an inexhaustible forest wealth has been always prevalent. This is readily explained by the distribution of the forest area. The dense and continuous forest which covered the Atlantic side of the continent and the immense forest growth that skirts the Pacific Ocean hardly suggested that nearly half the area of the Union in the interior, with the exception of the mountain slopes and along the river courses, was forestless if not treeless, and that the population which was to settle these fertile acres would have to rely upon the better wooded parts for material to build their houses and barns and their railroads.

During the 400 years since the advent of the Europeans on this continent this 60 per cent. or less of woodland has been reduced to below 25 per cent., not only by clearing for farm purposes, but also by most wasteful cutting and by careless use of fire, turning into useless brush or waste land what might have been an ever-producing resource.

No other people of the earth have consumed virgin forests as lavishly as have the people of the United States. With a present consumption of 380 cubic feet of wood per capita, of which over 50 cubic feet is lumber, they excel the consumption of Germany nearly nine times, that of France nearly 12 times, and that of Great Britain more than 20 times. And since, even for fire-wood, only sizeable timber is used, we may reasonably calculate that to furnish the total present consumption of 24 billion cubic feet or more continuously not less than one billion acres would have to be kept in good productive condition, while at present less than half that forest area exists, and is culled and cut without any regard to reproduction or future condition.

To be sure, there are still enormous quantities of virgin timber available, and although some valuable kinds, like the white pine, tulip popular, ash, and walnut, are or are soon to become practically exhausted, large stores of other timbers remain to supply us for many years.

Yet, even so, serious concern may well be caused with reference to our future supplies by the reflection that large areas of woodland which to the casual and uninitiated observer appear well wooded are so severely culled of the better kinds of timber that for supplies of material useful in the arts they must be counted as unavailable, the very fact that the inferior kinds were left being a serious detriment; reforestation with better kinds by natural reproduction being made thereby impossible, and by artificial planting being made too expensive.

While the rough estimates of our consumption and the condition of our resources are not reassuring of the future, the student of political economy may also figure out the loss to the national commonwealth by depreciation in productive and taxable power of the devastated thousands of square miles which are found wherever the lumberman has finished his work. Furthermore, the effects of improvident clearing or devastation of mountain forests have long become apparent in unfavorable water conditions and agricultural productiveness, just as experienced in other countries, like France, Italy, Austria, etc.

While the loss of material by fires, the scourge of all pioneer countries, in comparison with *bona fide* consumption is but a small matter, perhaps 2 to 3 per cent. of the consumption, the indirect loss caused by them can hardly be overestimated. Not only is the fertility of the soil deteriorated by burning of the mould, but the water-holding capacity of the forest floor, upon which depends the effectiveness of forest influence upon waterflow, is destroyed and, furthermore, conservative forest management is discouraged; the constant risk from fires is an incentive to turn into cash as quickly as possible what is valuable in forest growth, leaving the balance to its fate.

The bulk of the forest lands is owned by private individuals. The idea of State ownership of lands, except for public buildings, forts, etc., and for eventual disposal, has not been germane to the spirit of our institutions until a few years ago, when the friends of forestry succeeded in establishing in some parts a new policy. School lands, indemnity lands, swamp lands, and other lands which the General Government has given to the States or which they have owned otherwise have never been held for an income except by their sale.

Now, however, has not only the State of New York set aside a forest reserve of nearly 1,000,000 acres, to be gradually increased, but the President of the United States has received power to set aside from the public lands forest reservations, under which power some 17,000,000 acres of public timber land have so far been reserved, and at the present writing a bill for the rational management of this newly "sanctified" public property is on its passage through Congress, with a fair chance of becoming a law.

The private ownership of forests may be divided into three classes: the farmers who own wood lots connected with their farms, probably now not 30 per cent. being so owned; the speculators, among whom may be included all those who hold forest property temporarily for the purpose of selling it to obtain the unearned increment from the third class, namely, those who develop and utilize the forest resources—lumbermen and manufacturers, in whose hands finally the bulk of the forest area must fall, and to whom we, therefore, must look for a forest policy.

In addition to the owners of the natural forest resources we must not forget the forest-planters of the West. These are mainly farmers, and the plantations, mostly small groves, increasing in number, value, and quality, stand to the farm in the same relation as the

wood lot in Eastern States. Although this planted area has for the markets as yet no significance, furnishing hardly anything beyond fire-wood and fence material, it is beginning to satisfy the owners that forest-planting is advantageous in many ways, and the experiences gathered in these first attempts will be of value for forest management in the future.

Forest management as practised abroad, when timber is treated like a crop, being systematically harvested and replaced, is utterly unknown, a few feeble attempts on a small scale only being on record. Beyond an occasional attempt at protecting forest property from fire no attention is paid to it except when the wood is to be cut. Usually it is culled of its best timber and then left to its fate. In many cases, by injudicious use of the axe, followed by fire, it is turned into useless brush or waste land, with which many square miles are covered, or it is at least deteriorated in its composition. Thus a large proportion of what appears still well wooded is really of no account as far as supplies are concerned.

Such are the forest conditions of the United States.

The forestry problems are the same as those existing in all highly developed countries. There is no country in which they are fully solved; the difference is only in degree—some being nearer, others less near, to solution.

Broadly stated, the forestry problem of the world—and the same applies to the United States in particular—is, how to reconcile private interest in forest property with communal interests; how to secure the needs of the present without impairing the requirements of the future; how to utilize the forest material and at the same time preserve the forest conditions which are favorable to climate and waterflow.

Private interest, we must never forget, is resolved into the one word profit; and mostly only direct and immediate profit, expressible in dollars and cents, appeals to the private individual.

There is generally but little appreciation of indirect profits or of distant promises of revenue, and still less regard for neighbors or future generations in the conduct of private business.

These last considerations concern, however, the community. While the forest-owner may be satisfied to fill his pocket-book by wastefully cutting and marketing the best of his timber, leaving the balance to deteriorate, the community has an interest in seeing the resources not only fully utilized but continued in productive capacity; the community has an interest in maintaining supplies.

If the private owner does not care whether his forest property, after he has culled the marketable timber, falls a prey to the fire and becomes a waste, the community is certainly concerned in such a result, were it only to preserve the taxing value of its territory.

If by the reckless treatment of the mountain forest the waterflow is disturbed, this may not concern the forest-owner, but it does concern the community, whose duty it is to protect its members against damage by the inconsiderateness of others, to restrict such use of private property as is detrimental to neighbors or to other distant interests. Whatever may be thought of other private property, the forest, experience, experiment, and sound reasoning have shown, bears such a close relation to other cultural and to water conditions that the unrestricted exercise of property rights is apt to lead to conditions detrimental to the interests of the community and of coming generations. How and how far restriction may be applied, or how private forest-owners may be made to consider the interests of the community in the use of their property, or whether and where the community had best take possession of the forest property, that is the general forestry problem.

As far as the Federal Government is concerned, the solution of the problem has been fairly begun. If the present Administration be wise, it will reserve from sale all the remaining public timber lands—somewhat between 50 and 70 million acres only, mostly on the Western mountain slopes—and organize a management of this important property, by which its stores are used conservatively without impairing its reproductive capacity. Such management, crude and simple though it may be at first, consisting of protective measures mainly, may gradually develop into a rational system of forestry.

If the General Government fulfils this duty well, and in addition supports liberally the bureau of information known as the Forestry Division, it will have done all that may be expected of it; not that other aids and encouragements might not be given, such as the establishment of a chair of forestry at West Point, where officers may find instruction in the principles of forestry, fitting them to act intelligently as guardians of the public forest property; or the nationalization of an Arbor Day, to arouse more general attention to the subject; or by legislation regarding tariff on forest products, although at present it is questionable whether the retention or abolishment of the existing tariff may have any effect upon forest conservancy, except, as Mr. Little contends, to remove from the trade papers the

consideration of this subject and to substitute the discussion of forestry problems pure and simple.

But the main reliance for a conservative forest policy, as far as Government action is concerned, lies with the individual States. A beginning has been made in New York by establishing a State Forest Reserve, a feebler beginning in New Hampshire by continuing a Commission of Inquiry; a rational move is to be recorded from Maine in organizing a protection against fire, and a most systematic proceeding from Pennsylvania, consisting in a thorough investigation of the forest conditions of the State with a view to further action. In other States, like California and Colorado, political decrepitude has occasioned at least temporary setbacks to the attempts at establishing a rational forest policy, while in a few other States the movement has not advanced beyond the first stages of agitation and feeble attempts on the part of the governments to establish a basis for action or to disseminate information on the subject.

The first step to be taken by the various State governments, it seems to me, is to place forest property on an equal footing with other property and give it more ample protection against fire and depredation. This is not done by mere paper legislation, but requires provision of an executive machinery, the organization of a service which will be effective in the execution of the law, somewhat like that enacted in Maine and more fully set forth in the Annual Report of the Forestry Division for 1892.

The next step, still more readily made and requiring no new powers, is to provide for at least a short course of lectures on forestry at the agricultural colleges, so that more intelligence regarding the subject be instilled into the people. To this may be added scholarships to be given to students that shall enable them to study abroad the principles of forestry in application, and thus prepare them to direct intelligently the forest policy of their State and of individual forest-owners. A third step, also of ready accomplishment, is to encourage by legislative enactments, similar to those of Massachusetts but more comprehensive, an interest in forest property on the part of villages, towns, and corporations, offering an incentive to them to own and manage such forest areas as appear of essential value to the maintenance of favorable conditions in the community.

Lastly, after such careful survey as is now being made of forest conditions in Pennsylvania, the State should possess itself of such

forest areas as are essential for the maintenance of favorable water conditions, if the smaller communities cannot be expected to do so. These lands, as well as any other forest property of the State, school lands, indemnity lands, etc., should then be properly administered; and while the object of such a State management is not that of private management, namely, profit, such State forests would nevertheless not only be indirectly profitable, but in time become one of the most valuable properties the citizens of the State could boast of.

With such encouragements on the part of the Government as indicated, private forest-owners will soon take advantage of the improved state of affairs and apply such conservative methods as do not curtail their present income too much.

Whatever we may think, theoretically, as to the right and propriety for the State to restrict private owners from exercising their full property rights when it is evident that such exercise is detrimental to the interests of the community, practically we shall not soon see the day when this evident right and propriety of interference will be exercised in this country. Hence, unless the State become itself owner of the land—which, as long as there is valuable timber on it, will also not readily be done in our country—only indirect influences can change the methods of individual owners.

These influences are the increased protection extended to forest property, the opportunity of acquiring the necessary knowledge needed in forest management, the general interest, and the good example exhibited by the State in the management of its own timber lands.

By and by, when it becomes also more evident that the supply of virgin timber is wanting, and that therefore greater profit is to be expected from a conservative treatment of the remaining timber lands, these influences will find their reaction in the methods of the private owners.

To bring about all these various things which are to help in the solution of our forestry problems, it is most needful to enlighten the public as to the true meaning of the problem—to make such propaganda among all classes of our people, and especially among those who own forest property, as will secure an expression of the popular intelligence and will. This is done by associated effort of those who understand the need and importance of action, and it must be done with reference to local conditions in each section of country.

Hence the first, most important, and most promising step towards the solution of our forestry problems is the formation and active exertion of State Forestry Associations, whose function it must be to shape and bring to execution a State forest policy.

Such associations should be composed of business men, men who own and use forest property, lumbermen and manufacturers, who are broad enough to see the need of adjusting private and communal interests on a rational basis, and that private interest will not suffer when communal interest is subserved.

Mr. Fernow then introduced the next speaker in the following words :

"I have alluded to the one step which the Government of the United States has taken towards establishing a new forest policy in this country—the law permitting the reservation of forest areas. What a mighty step this is he only can realize who knows how difficult it is to move a popular government to action. To make this step has required a great deal of perseverance in our propaganda, but even after the law has reached the statute-book it may find the fate of three-fourths of our legislation, becoming inoperative for lack of an executive officer behind it who recognizes its value and brings it to execution. We have with us to-day the man to whom the United States owe more in the establishment of a national forest policy than to anybody else, for he brought that law finally into existence by applying it—by setting aside, under the President's authority, the first forest reservations, thus making the United States own lands for other purposes than for sale. I have the honor of introducing to you the ex-Secretary of the Interior, Honorable John W. Noble."

Mr. Noble spoke as follows on Our National Park and Timber Reservations ; their Importance and Proper Administration :

OUR NATIONAL PARKS AND TIMBER RESERVATIONS; THEIR IMPORTANCE AND PROPER ADMINISTRATION.

Mr. CHAIRMAN AND GENTLEMEN :

I recognize that my invitation to this important congress is due rather to my official action, while at the head of the Department of the Interior, in support of the policy of reserving the forests at the fountain-heads of our rivers, and the establishment of our great

national parks, than to any particular qualification on my part now to contribute anything of importance bearing upon the subjects before you for discussion. When the opportunity offered I did my best to aid Congress and the President to inaugurate and advance the policy of timber reservations. That policy has already set apart, besides the national parks, more than seventeen million acres of the public domain, to remain unconverted into private fortunes, and with their mountains and forests, rocks, ravines, and undergrowth, their glaciers, snows, and streams, their storms and sunshine, to preserve and perpetuate timber for the people's use now and hereafter, and, together with the equable temperature of the zone we inhabit, the humidity of the atmosphere and soil, the fulness of the rivers that are to fertilize many millions of acres of our arid lands, to become no more admired and frequented for their wonders and grandeur, their fauna and flora, their health-giving freedom and soul-lifting beauty, than loved for the safety and prosperity they will continue to confer upon new American homes, communities, and States. The interest taken in the subject by you men of science, and the arguments presented, have rendered it possible to make such progress that the state has given recognition to the policy and placed itself upon that high plane of economy and statesmanship that recognizes the riches and beneficence our forests embrace, and that, looking to the welfare of the future generations no less than those of to-day, subjects individual greed to lawful and politic restraint, and compels the inordinately selfish to bide the national welfare.

We have thus been brought into relationship with the other civilized nations of the world on this subject, together with many others, for the science and practice of forest culture and preservation have long been recognized by the nations of Europe as most important. Those nations are interested in our action, as we should be in theirs. The woods of all countries, like their other products and manufactures, have become interchangeable commodities, contributing to the commerce and comfort, wealth and refinement of the different nations of the globe. We are thus able at this congress to contemplate our interests in this department, not only as to our own territory but in relation to those of other people of the world, and by the interchange of knowledge and opinions prepare the way for an international association for the promotion of forestry science.

It has become a prominent duty of the hour to consider the per-

petuation of the blessings we enjoy. The fact that many generations of men must pass away before a forest can be renewed, and its unwise destruction can be remedied, adds a gravity to your councils and an importance to your success for humanity's sake, unsurpassed by any other; for how much of religion, science or art, education, refinement, and progress can there be in a dominion robbed of its forests and its homes, to all "hastening ills a prey"?

I speak within the bounds of experience and upon the authority of great men who have given this subject their investigation in many lands, and bestowed upon it the thought and labor of their lives. Humboldt has written that in felling trees growing on the sides and summits of mountains men under all climates prepare for subsequent generations two calamities at once—a lack of fire-wood and a want of water. Others have declared that by the fatal connection of cause and effect, which begins with the destruction of forests and ends in the miseries of the population, man is doomed to share the ruin of the soil which he has devastated; that forests given up to sheep, and forests destroyed, make the mountains devoid alike of woods and of life; that forests exploited on no settled system, left open and subject to depredations by the natives, desolated by frequent fires, ruined by the passage of flocks of goats and of sheep which devour the young twigs and shoots, as witnessed in Algiers, yield no revenue and are soon annihilated; that forests are similar to the sea, in their influence reducing the natural difference of temperature in different seasons, while their destruction increases the divergerence between the extreme heat and the extreme cold, imparts greater violence to atmospheric currents and to torrential rains and protracted duration of droughts; that it is not wars which have brought most evil upon the region of the Mediterranean, but aridity, brought on and aggravated by the reckless destruction of woods and by the excessive abuse of pasturing sheep on the mountains; that while there can be raised one of the finest vines on the Rhine, where two thousand years ago no cherry ripened, on the other hand those lands where the dense population of the Jews was nourished by a fruitful culture are in the present day half deserts; the cultivation of clover, requiring a moist atmosphere, has passed from Greece to Italy, from thence to Southern Germany, and is already beginning to fly from the continually drier summers there, to be confined to the moister north; rivers which formerly scattered blessings with equal fulness throughout the whole year now leave the dry and thirsty bed to split and gape in summer, while in

spring they suddenly pour out floods from masses of melting snow, accumulated in winter, over the dwelling-places of affrighted men.

This epitome expresses but a part of the opinions gathered by Dr. Brown in his book on Modern Forest Economy, published at Edinburgh in 1884, and were I a Senator I might read the whole book as a part of my speech, but, as I am here with the majority, I refrain. The fact is recognized by all scientific men, that whether or not the forests cause any increase in the rainfall in the regions where they flourish, they do retard the flow of the rainfall after precipitation and maintain a general humidity of the atmosphere and the soil. One author goes so far as to say that the measure of attention given to trees indicates the condition of agriculture and the civilization of a country.

I have read with interest and instruction in the publications of the American Economic Association for May, 1891, the valuable papers of Mr. Fernow, Mr. Pinchot, and Mr. Bowers, and I wish these could be placed in the hands of all our people. These papers, and others like them, could be made the basis of instruction in our common schools and colleges. They present the American view of the question of forest administration in a lucid, convincing way and entirely overthrow the ignorant assertion of some, that the subject of forestry is a hobby, or, at best, an entertaining theme for enthusiasts or sentimentalists.

It will not be deemed invidious, I am sure, for me to also note the efforts in this behalf of the American Association of Science, which, by its president, Professor Mendenhall, its secretary, Mr. Fernow, and their associate committeemen, Messrs. Hilgard, of California, Berry, of Nebraska, and Saunders, of Canada, presented to the President of the United States a memorial on behalf of a proper forest policy, which the President transmitted, with an accompanying message, to Congress on January 20, 1890. This was seconded by another petition of the American Forestry Association and those interested in forestry, to have forest reserves made. This policy was advocated by the administration and has been generously supported by the one now in charge of the Government. It has not been touched by politics, and is receiving both national and local support, with some occasional obstruction by those who are personally interested in appropriating the earth to themselves, or who are uninformed as to the proper functions of the State and the true purpose of its existence.

There had been established already by special acts of Congress

the Yellowstone National Park, the Yosemite, the Sequoia, the U. S. Grant, and the reservation of the Hot Springs of Arkansas. These are placed under the supervision and protection of army officers with cavalry troops especially detailed, or a superintendent especially authorized for the purpose.

Where such magnificent and wonderful natural objects exist as may be found in either of these preserves, the public has been at once convinced of the propriety of governmental care. There is, perhaps, no disinterested person who would desire or consent to the repeal of either these acts of Congress, or allow they should be so relaxed as to threaten the serious impairment of the reservations. It is true, private interests, regardless of the public welfare, oppose some of them, but this is rather to be attributed to selfishness, regardless of the public welfare, than to a want of appreciation of the national benefits secured. These assaults have, so far, been fruitless, and we hope will soon, if they have not already, become wholly discouraged. These parks are in great measure exponents of our civilization; our advanced recognition, not only of the wonders and benefits bestowed upon our country by nature, but also of our responsibility to all the world for their preservation for the instruction and enjoyment of the present and future generations of mankind. They are already celebrated among all nations, and literature and art have made them familiar in all households of intelligence. To the present World's Fair they have supplied objects that have gained as much attention and given as much entertainment and pleasure as any here exhibited. They should and must be maintained.

They are, moreover, valuable object lessons for the treatment of those other timber reservations now widely made. Captain Wood, acting superintendent in the reserve about the Yosemite Valley and of the reservation about the great trees, who has command there of a cavalry troop, states in his report for the past year that while two fires occurred, they were both subdued. One reached the Tuolumme Grove and barely touched one of the Sequoias, without injuring it. This spread from the fire left by some careless camping party. The other was extinguished by driving it against the south fork of the Tuolumme River. This originated outside. There have been no appropriations to supply means to extinguish such fires, and the troops had to resort to gunny-sacks, brush brooms, and other crude devices. He remarks that the fires there do not make much of a current of air, burn slowly, and can usually be approached

with impunity. He suggests that with iron headed and toothed rakes advantage could be taken of the open spaces and the combustible matter there so arranged as to back-burn and thus check the fire effectually. It is to be also mentioned that the captain has ejected the sheep-herders and their flocks on their every advent, and that, too, without much ceremony.

Captain Anderson, in charge of the Yellowstone National Park, and also in command there of a troop of cavalry, has reported that after two years of remarkably good fortune in dealing with fires, there occurred in July a disastrous one, but all the available men watched and fought this fire for two weeks, and at last, when the report was made, it was deemed under control. The report is very instructive as to the great increase of game and fish in the reservation, but my purpose is to illustrate, by the references made, how efficient these forces have been, although almost without means, to discover and check that greatest enemy of the forest—fire. Certainly true statesmanship would at once supply both exact laws and efficient means to defend them from all depredations and losses inflicted by lawless men or the elements, and these laws and means should, in like wisdom, be extended to the greater timber reservations.

Of the timber reservations, we now have the following: In Colorado, that of the White River Plateau, of more than a million acres; the Pike's Peak, of nearly two hundred thousand acres; the Plum Creek, of about the same dimensions; the South Platte, of more than half a million acres; and of the Battlement Mesa, of over eight hundred thousand acres. In New Mexico, that of the Pecos River, of over three hundred thousand acres. In Oregon, that of Bull Run, of nearly two hundred thousand acres; that of the Cascade Range, of about four million and a half acres; and of Ashland, embracing nearly nineteen thousand acres. In Wyoming, the addition to the Yellowstone National Park, of nearly a million and a quarter acres. In California, the San Gabriel, of over half a million acres; that of the Sierra, of over four million acres; of the San Bernardino, of over seven hundred thousand acres; and that of the Trabuco Canyon, of about fifty thousand acres. In Washington, that of the Pacific, of nearly a million acres. In Arizona, that of the Grand Canyon of the Colorado, of over one million eight hundred thousand acres. In Alaska, that of the Afognak Forest, and Fish Culture Reservation, embracing the whole island and circumjacent rocks and waters. These reservations embrace in all over seventeen million acres.

These reservations are chiefly at the sources of great rivers and among the mountains, and all in regions almost altogether unsuitable for agriculture. No doubt parts of each could sustain a few farms or ranches or graze a small number of cattle, but in the main they are as I have designated. They were each carefully inspected by competent officers, who not only with great labor traversed these distant and almost inaccessible wilds, but canvassed for the public opinion of the people around about where they were made, and gave long and exact notice of the purpose for making these reservations. They were made with careful preservation of all existing legal claims by individuals. They are not so reserved as to be of use only in their natural unimproved condition, but those interested as a community are allowed to go upon them for the purpose of accumulating and directing the water for the general use; but not to destroy or individually appropriate to personal advantage what God and the Government have ordained should be for all. An illustration or two will show the general purpose.

From the Sierra Range, where are reserved, as we have seen, the four million acres, run the waters to feed the streams of the San Joaquin Valley. In these vast solitudes are garnered snows that in places reach the depth of forty feet, and there are forests and undergrowth, of great extent, that in their natural condition protect and preserve the waters, as the snows melt, in such degree that they supply the rivers for a great part, if not the entire summer, making the lower lands, under due cultivation, fruitful and the pride of the State. But already, before the reserve was effected, the sheep-herder was gradually invading these mountains with his immense flocks, making havoc on all sides. These flocks, as we have already noted, as they have done in other lands, were rapidly denuding the surface of all herbage, and each succeeding year the herder was increasing in his anxiety that the sun should have early effect upon the snow, and that the waters should escape that the grass and flora might the earlier appear and be available for forage. It was but a duty of good government to stay this vandalism and assert the national power to secure a nation's rights.

In the vast area around the Yosemite Valley, the sheep had, before that reservation by Congress, already cut down the undergrowth, so that there was scarcely enough even for the sheep themselves, and the goat would soon have had to be substituted, as in Algiers. This reserve, under the protection of the United States cavalry from May to November, is once more assuming the condi-

tion of usefulness and beauty that gives assurance of permanent future prosperity to the neighboring valleys.

Along the Colorado Canyon grow the most extensive forests of large pine trees, and with these are associated the attractions and wonders of the canyon itself, explored by and to be ever associated with the name of one of the best friends of the cause we advocate—Major J. W. Powell. These the railroads and the timber speculator have not yet reached. When they arrive, there will be a mighty effort of the lobby to undo the reservation and confer upon individuals and corporate bodies the wealth of the people and the safety of future generations. It is to be hoped, and indeed it may now be well expected, that the strength of your associations will have so increased, and the knowledge of what is at stake so generally diffused among our citizens everywhere, that all such efforts will fail, and the legislation in behalf of all these reservations will have become more elaborate and effective and worthy of our Government, so that the great trust Nature and Nature's God have imposed upon us will be regarded and enforced.

What should be the detail of that protection there is not time to specify. But this much is apparent: the forests already reserved by executive proclamation should be confirmed by statute; they should be surveyed and plainly marked by lasting monuments. Around about them and through them at moderate intervals should be made passage-ways sufficiently wide to form barriers to fires; over them should be appointed superintendents, each with a corps of mounted guards to patrol and protect the woods from fire and spoliation. Concerning them should be established rules for their legitimate and needful use by the people, according to the demands of agriculture and homes, with exact and severe penalties for all wilful violations of the law and all fraudulent practices; and, behind all, a bureau with schools of instruction to prepare those to be employed by intelligence and experience for the exact and efficient performance of their forestry duties. The system should be extended over the Indian reservations. No better or more rational instruction could to-day be conferred upon the Indians themselves, who possess great forests, than instruction in forestry, so that they should appreciate and economize the wealth they have. The rules of civil service should be applied to the officers and most of the employees at the reservation, so they would represent the people and not politicians.

If we can thus preserve these vast and valuable domains, the

great system of irrigation now so rapidly advancing will grow to the full extent of redeeming many millions of acres of the arid lands, and be continued to all coming generations. Nature, aided by man's intelligence and industry, will bestow her waters upon the deserts, and our ever increasing and expanding population will enjoy a new and unexpected inheritance, now abandoned to the sagebrush and the cactus. There will arise new fields of fertility and new avenues of commerce. The products of the labor at the homes and cities there in agriculture, horticulture, and manufactures will secure for the inhabitants a prosperity and a civilization that will vie with, if they do not surpass in variety and splendor, those of our proudest rain-blessed commonwealths. Instead of such desolation as that of the lands along the Nile, the Tigris, and Euphrates, which now characterizes our arid regions, they will create and sustain communities and cities with which Alexandria, Nineveh, and Babylon in the height of their power cannot be compared; for they will not only exceed them in wealth, power and refinements of life, but they will enjoy a Christian civilization and the blessings of a free republican government.

NOTICE.

This is the second fascicle of Vol. X of Proceedings, comprising pages 45 to 92.

For non-members, the price for each fascicle will be 25 cents; the whole volume, \$1.00. Copies can be had by addressing Forestry Division, U. S. Department of Agriculture, which has undertaken to act as distributing agency for these publications.

THE RELATION OF FORESTS TO CLIMATE AND HEALTH.

BY CLEVELAND ABBE.

[Read at World's Fair Congress, Oct., 1893.]

The surface of our globe is about four-fifths water and one-fifth land. Of this land one-fifth is now or was covered with forests before man destroyed them. We have therefore to recognize the fact that only one-twenty-fifth, or four per cent. of the surface of the globe, is naturally covered by forest areas, and that these can therefore exert a relatively small and not a preponderating influence on the general condition of the atmosphere.

On the other hand, the areas that would naturally be covered by forests are precisely those in which man loves to dwell. The trees afford him shade, food, and lumber, and their decayed vegetation has covered the naked, barren clay, gravel, sand, and rock, with a vegetable mould in which he can raise the plants that he needs for food and clothing. Undoubtedly, man may be properly considered an animal adapted to live in groves and forests, and in clearings in the midst of the forest. He was not originally an arctic animal, nor an aquatic creature, nor a denizen of the prairie; but from his natural history we can safely infer the correctness of the Mosaic record, which asserts that our ancestry began among the trees of the Garden of Eden. There is an intimate relation between the forests of the world and the migrations and development of the human race. Although the forests may not affect the atmosphere or the average climate of the whole earth to any great extent, and although their very existence depends upon certain broad climatic conditions over which they have no control, yet within a certain limit they produce a local climate of their own which is extremely favorable to the prosperity of mankind. Barbarian tribes have always sought the forests as a home, civilized man has destroyed the forests; a higher civilization teaches us to restore them.

METEOROLOGICAL INFLUENCES OF FORESTS.

The actual difference between the climate in a forest region and that which would exist were the forest cut away gives us a proper

measure of the influence which that forest has exerted by its presence in modifying the local climate, and it is this local modification that we are interested in.

1. The temperature of the soil and its drainage water is on the average much lower within the shade of a forest than in the open sunshine, and this effect is greater as the forest is denser; the mid-day temperatures and the mid-summer temperatures of the air within a forest are reduced much more than the night and winter temperatures are raised. In general it is even so much warmer under the forest at night-time that frost cannot occur on the surface of the ground in the early morning hours.

2. In the daytime the mean temperature of the air in the tree-tops is rather higher than at the same height above ground in the open fields. The mean temperature below the tree-tops at four or five feet above the ground is lower in the forest than at the same height over open fields. Again, the mean temperature at considerable heights above the tree-tops is somewhat higher than at the same total height above ground in an open region. Evidently the sunshine caught by the leaves and branches of the crown of the tree warms up not only the crown but the air above it to a less extent, but very much as if the surface of a meadow had been raised to the level of the crown of a similar tree. A similar condition exists when the earth is shielded from sunshine by the clouds and fog. Just as the surface of the ground is hotter than the soil beneath or the air above, so the crown of a forest is warmer than the air below and the air above it. A small fraction of the slightly higher temperature within a forest may also be due to the heat given out by the chemical processes involved in the growth of trees.

3. *Humidity.*—Within the forests the quantity of moisture thrown into the air by transpiration from the leaves is far greater than the evaporation from a water surface that is not exposed to wind and sunshine; but under the influence of wind and sunshine the transpiration from the leaves is less than the evaporation from a water surface. The evaporation from a saturated bare soil in the cool shades of the forest is about the same as from a water surface in the same position as to wind and sunshine. The total quantity of moisture returned into the atmosphere by transpiration from the trees and by evaporation from the soil of a forest is about 75 per cent. of the precipitation, whereas the evaporation from the same soil when away from the forest is scarcely 30 per cent. of the pre-

precipitation. Therefore the tendency of a forest is to increase both the absolute and relative humidity of the atmosphere; forests of evergreens have two to four times the influence in increasing the relative humidity than forests of deciduous trees.

4. *Rain and Snow.*—Some have maintained that at stations within a forest the rainfall is actually larger than at points beyond the forest influence; personally I believe that although the quantity of rain caught in the gauges may be larger, yet this excess is principally due to the absence, at the forest gauges, of such strong winds as prevail in the open fields: a strong wind diminishes the catch of the gauge (unless the mouth of the gauge be protected), but does not diminish the true rainfall itself. On the other hand, the tendency of the loose soil of the forest is to absorb and retain much more moisture than is held by the firmer soil of the open prairie; therefore both the texture and the temperature of the soil conspire to enable it to retain a large proportion of the rainfall. Moreover, the snow that is protected by the forest from the sunshine and wind is thereby prevented from melting and evaporating rapidly. The annual evaporation at the surface of the ground is about 12 per cent. of the rainfall within the forest, but about 40 per cent. in the open field. We see, therefore, in every respect the tendency of a forest to conserve the rainfall. It not only shields it from evaporation and uses less of it for the growth of the forest than would be used in the growth of grasses or herbs, but it conserves what is left in the forest soil so as to diminish, or at least regulate, the drainage into the river basins, thereby diminishing the danger of destructive floods.

5. What we have said with reference to the temperature and moisture of the soil and the air within a forest applies to a less extent to the influence of the forest on the climate of the neighboring country. Stations located in small clearings or openings, or forest glades, are of course most influenced by the surrounding trees. Stations on the windward side are more influenced than those on the leeward side. Dense forests have a stronger influence than the lightly forested country. Forests in regions where light winds prevail have a greater local influence than those in the regions of strong winds. Forests located on mountain sides and highlands have an influence on the temperature and moisture of the country below them. The cool and moist air of the forest, by settling downwards in the daytime, although it is warmed dynamically as well as by isolation, still preserves a lower temperature and a

higher humidity than would have prevailed in the case of no forest. In the afternoon hours this influence of the forest air may become so great as to have an appreciable effect in slightly increasing the intensity and frequency of the local thunder-storms. The so-called vertical gradient of temperature, or the diminution of temperature per hundred feet of ascent, must be 0.55 degrees F. or more per hundred feet when the lower atmosphere is in the condition that is called stable equilibrium. This condition of stability always prevails within the forest on a horizontal plain, so that storms do not originate within it, but the relation of the forests on the mountain sides to the air of the valley below may easily be such that in the daytime instability exists and the cool forest air descends, pushing up the hot air of the lower valley until a cloud and rain or thunder-storm is formed. On the other hand, at night-time this same forest keeps its air from whirling rapidly, and therefore will not send the air down to the cold valley below. Therefore the influence of forested hilltops is quite the opposite to that of the naked surfaces of stony peaks and bare fields of deforested areas, whose heated surfaces send up hot air by day and send down cold air by night. Thus the effect of the forest-covered mountains is to diminish the cold night winds and the hot day breezes in the valleys below and to favor the formation of local cloud and rain in the valleys.

As the air that flows down the mountain side during the night from a forest has a higher dew-point and a lower temperature than that which flows down from an unforested surface, therefore a less amount of cooling will cause it to form fog; hence the crops in the valley are more likely to be sheltered by the fog from dangerous frosts.

During the night-time the air within a forest is warmer than that above it, and the so-called stable equilibrium slowly rises, while the cooler air above percolates downwards through the leaves. If the forest is in a level plain or at the bottom of a valley, then this interchange is a very slow process, and no sooner does the warmer, moist air ascend and mix with the cooler air above the tree-tops than its temperature begins to cool enough to form a fog in the early morning hours over the forest instead of beneath the forest as when the latter crowns the mountain-top. By this formation of fog the forest again shows its ability to favor the retention of its heat and prevent injurious frost.

On the leeward side of a forest the effect of the circulation or

interchange of the interior and exterior air is appreciable for a short distance, especially in the summer-time. The most interesting forest influence on the leeward side is that which it exerts by virtue of its action as a wind-break ; but for this purpose a forest is scarcely necessary, since the few rows of tall trees or a small woodland break up the power of the strong winds of our prairies. It has, in fact, been customary to plant rows of trees running north and south so as to break up the cold, dry, west winds without cutting off too much sunshine from the soil. A series of wind-breaks may be considered as a forest that has been thinned out until it has become a series of clearings or glades. Within such glades we have less wind, therefore there is less evaporation from the soil, therefore the temperature of the soil is higher and its moisture is greater ; similarly, the temperature of the air is higher, and all these conditions favor the growth of plants. On the other hand, these same conditions also increase the liability to injurious frosts during still, clear nights, and more especially because the increased heat of air and soil in the daytime stimulates the plants to a more rapid and delicate growth, that is more easily injured by frost ; but this latter danger is again set off by the increasing tendency to form protective fogs.

The protection that a forest offers as a wind-break to the adjoining fields on its leeward side is effective not only by diminishing the force of the wind, but by the consequences that flow from this latter action. A diminished wind means that the sluggish moving air shall be warmed up in the daytime by contact with the ground, much more than would be the swiftly moving air when the wind-break is absent. This reacts upon the ground itself, so that as a consequence both soil and air are warmer.

The evaporation from the surface of the soil is also greatly diminished, in consequence of which not only does the soil retain more moisture, but it is also warmer than it would be under the influence of a strong wind. At the same time, the air above the soil acquires a higher percentage of relative humidity. For both these reasons the plant has more water at its disposal stored in the earth, while the leaves, apparently, are in less need of water and transpire less. In this manner a wind-break contributes to preserve the plant against droughts. A double row of tall trees 500 feet apart, running north and south, has a sensible effect and will effectually protect a large area.

Not only is the soil kept slightly warmer, but it is even prevented

from freezing, and, in addition to this, the snowfall is distributed so much more evenly in the lee of the wind-break that, when it melts, a much more uniform amount of moisture soaks into the warm, porous, unfrozen soil.

The forests upon a mountain side exert an indirect influence in increasing the quantity of moisture that eventually reaches the ground, but one that is only appreciable when the forests are themselves involved in the clouds which form high up on the mountain side. These clouds, which, to a distant observer, seem stationary and attached to the mountain, are really permeated by strong winds, and every globule of moisture that helps to make up the cloud is being rapidly carried by the wind from one side of the cloud to the other. The little globules become visible on the windward side of the cloud, they grow a little larger, then begin to diminish, and by the time they reach the leeward side they have evaporated and disappeared entirely. Meanwhile many of them have struck the mountain side; the rocks are everywhere moist with them; the leaves and the branches are dripping, and so far as this drip soaks into the ground it abundantly serves the place of an ordinary rain, which, by its continuance hour after hour and day after day, maintains the mountain side in a state of perfect verdure. This drip of the trees gathered from clouds and fog goes far to maintain the woodlands of Maine and Maritime provinces of Canada. It supports the rare orchids on Table Mountain and the lichens on the black rocks of Pungo-Andongo and gives to the Island of Ascension its beautiful Green Mountain. But this mechanical action by which the leaves catch the floating globules of the cloud is, of course, also a very local action; nevertheless, it is extremely important, since by this process all the mountains of the world might be covered with forests without the help of rain. By this process the presence of forests in the cloud region itself determines a slight increase of catch of moisture, and this increase is larger for forests than for the bare rocks and soil, although it is appreciable even for them. Evidently, the catch depends directly upon the area of the leaf surface and the velocity of the wind. I estimate that on the summit of Green Mountain the leaves, against which the clouds are driven with little intermission, night and day, catch an equivalent of one inch in depth of rainfall daily; but it must be remembered that this so-called drip covers but a very small area of the island and is followed by a very rapid evaporation as soon as the water has descended a few rods below the dripping

trees. This really enormous catch is paralleled by the great growth of frost work in the winter season on Mount Washington and other summits. The correspondingly enormous loss by evaporation within a few minutes after the water is caught makes this form of precipitation almost useless for agricultural purposes; it is as though one perpetually washed the leaves without wetting the roots.

The ability of the forest soil to hold a large quantity of moisture is peculiarly important when the trees have overgrown the moraines of boulders and gravel left by recent glacial action. The best illustration of this is found in the forests from Maine to Labrador. Here the soil is often only a mass of large boulders, on and between which lichens and mosses first grew in the days when the surface of the ground was higher above the sea-level than it now is. Into this mass of hard rock and fine vegetable mould the roots of the great forest trees deeply penetrate, and this matrix affords all the mechanical support and liquid nourishment that is needed. This matrix covers the land to an average depth of five feet; the volume of the spongy matter contained therein is equivalent to an average depth of $1\frac{1}{2}$ feet, while the volume of the rock is equivalent to a depth of $3\frac{1}{2}$ feet. The volume of water that can be absorbed by the spongy soil is fully equivalent to a depth of nine inches. When a forest fire has consumed this spongy soil and left little else than naked boulders, a hundred years is needed to even partially replace this loss, and meanwhile the falling rain-water drains rapidly away, producing floods in the rivers and leaving the land exposed to droughts. To preserve our forests is to preserve this precious water for the use of animals, plants, and men.

HYGIENIC INFLUENCES OF FORESTS.

The relations of forests to the biologic and hygienic conditions in their immediate neighborhood are, I believe, only beginning to be realized, and I would express my conviction that in hygienic matters the forests have an influence that extends far beyond their immediate neighborhood, and that is far more subtle and more important to the human race than are their purely meteorological or physical influences. The word "climate" is used in two very different senses by the meteorologist and the sanitarian. To the former it means the characteristic combination of temperature, moisture, sunshine and rain, wind and pressure; but the sanitarian adds to all this a very important property of the atmosphere which is not

generally considered by the meteorologist—namely, its power to carry from place to place those minute particles of dust and those minute living germs of disease which often decide as to the habitability of any place and affect the development of the human race as much as do the meteorological elements.

It seems to have been abundantly demonstrated that mankind flourishes when the atmospheric conditions are uniform, as also when the regular diurnal and annual changes, no matter how severe they are, can be clearly foreseen and provided against. It is the irregular, sudden, or the so-called non-periodic and almost abnormal changes, especially of temperature and moisture, that are injurious to the human race, and the more so in proportion as they are unforeseen and cannot be suitably provided for. This leads me to remark that the great development of the modern weather bureau, with its telegraphic predictions of blizzards, cold waves, frosts, rains, and storms, which are now so common in every civilized nation throughout the globe, has done quite as much to ameliorate the hygienic conditions of mankind as it has done to benefit the agriculturist or to save life and property at sea. The modern weather bureau is one of the most beneficial applications of human knowledge. From many points of view every living being depends upon the atmosphere for his prosperity, and needs to be forewarned of its occasional irregularities. Therefore, while we give a few minutes to consider the influence of forests in ameliorating the hygienic effects of a variable climate, we must also bear in mind that most of the unpleasant features can now be largely counteracted by a proper use of the observations and predictions of the daily weather map.

A sudden fall in temperature—and in the United States we sometimes have a fall of 40 Fah. within an hour—is, of all meteorological phenomena, the most fatal to human health and life, and especially when it is accompanied by high wind and a blinding snow or sleet or rain. Cold waves of this kind sweep over Texas and Florida and eastward to Maine; similar cold blasts, known as the bora in Southern Russia and as the buran in Siberia, sweep over these countries; a corresponding phenomenon is known in China; the pamperos of South America, although not so cold, belong to the same class of winds. Inasmuch as a forest growth does slightly diminish the tendency toward sudden changes of temperature, it has been said that possibly these extended storms could, by the forests, be mollified as to their severity or diminished as to their

frequency ; but a more thorough study of the mechanics of the atmosphere and the origin of these winds will, I think, serve to show that this hope is not likely to be realized, since the forest influence is too slight and we must look to the weather bureau to forewarn us of the coming of these cold storms, which, in fact, are able to destroy the forests themselves.

If we except these great atmospheric phenomena, we may say that our forests do favorably affect the atmosphere in its relations to human health and life. The prominent hygienic relations between mankind and forests consist, as I look at the question, in the following particulars, which I need only to briefly mention in order that their importance may be recognized :

1. A forest reserve constitutes the best means of collecting and storing up water for domestic use in cities and for manufacturing purposes on rivers and small mill-streams. A city whose thousands depend on a reservoir of water is brought face to face with epidemic if it is polluted, or with famine and pollution if drought prevails. The only known remedy for this disaster consists in maintaining a forest reserve ; artesian wells may do for small communities, but the cool forest alone suffices for the needs of a large population.

2. A forest reserve constitutes the ideal ground for that recreation that is absolutely essential to health and happiness of the Caucasian and Aryan races. The prairie and the ocean must be supplemented by mountains, forests, and lakes if we are to have an ideal globe. Without forests we go back to the condition of China, Persia, Asia Minor, and Turkey. A grove or thinly wooded country gives the natural and the best protection from the too powerful rays and heat of the sun. There are races that have developed under the influence of life on the treeless prairie. Such are the Cossacks, Tartars, and Samoyeds of Russia and Siberia, the natives of the pampas of South America, the Comanches, Sioux, and Esquimaux of North America. There are other tribes that have been built to stand the freest exposure to the hot sun of the tropics, as the African negro ; but wherever the higher civilization of the Caucasian race has penetrated it has been necessary for them to avoid the action of the midday sun on the brain and nervous system, and to cultivate thick protection for the head. Our own race, which is now peopling America, must learn to cultivate the conditions that favor life and health ; it finds that the forest is a necessity ; trees must be planted even in our cities, shade must be provided, and the

eye must be relieved of the blinding glare of the full sunshine ; the skull must be protected by turban or hat. The death of John Carver, the first governor of the Plymouth colony, in April, 1621, was a case of cerebral meningitis, following a sunstroke, on the first hot day of the early spring, and has been followed by so many similar cases throughout the Atlantic states that the sunstroke is universally dreaded in this country.

3. There is another class of forests, such as those of the eucalyptus, concerning which it has been maintained that these have remarkable efficiency in absorbing the excessive water from marshy soils, thereby drying up the excess of water and diminishing the intensity of malarial fevers. If this were true, the forests would be peculiarly welcome from a hygienic point of view, but I will not maintain that this proposition has as yet been very satisfactorily demonstrated. I incline to a slightly different explanation of the phenomenon, the tenor of which may be gathered from the following paragraph :

During the past ten years both sanitarians and biologists have become convinced of the profound importance of bacteriology in connection with the health, the disease, and the death of all the forms of animal and vegetable life. The cholera germs spread over Asia and Europe from the polluted waters of rivers ; the malarial fever germs in the severe types belong to the marshes and river bottoms that bake in the sunshine of Africa, India, and other hot countries ; the malaria of milder types comes from the somewhat cooler climates where the forests have been cut down and the soil turned up with the plow. The typhoid and the yellow-fever epidemics have in some way to do with high temperature and soil and water, but nowhere have the bacteria that are injurious to man been found flourishing in the oceans or the forests. We have indeed in the forests many forms of decomposition going on ; moulds and fungi abound, but these all flourish in diffused light or darkness, and at low temperatures, and do not spread very rapidly or far owing to the feeble winds within the forest.

It would seem that the higher forms of bacteria, which alone can live and do injury at a temperature of 104 Fahr. within the human body, do not thrive at the low temperatures prevailing in forest soil, although they may possibly exist there ; but when this soil is washed down to muddy flats and baked in the sunshine, or when the forest is cut down and the land cultivated by the farmer, who welcomes the sunshine as his friend, then the hot surface soil be-

comes the very nidus that is needed for this form of bacterial development. Just as a field or a city park strewn with stable manure too often gives up to the winds the bacteria of diphtheria and spreads that fearful scourge, so do the ploughed fields of a fresh clearing in the woods give up the germs of malaria to the winds, and they are thus carried to the greatest distances. Who does not know of the sickness that pervades the communities that live on the leeward side of swamps and river flats?

As I write these lines my eye lights on the following paragraphs by Stanley in his "Darkest Africa" (Vol. II, p. 31):

"While we have travelled through the forest region we have suffered less from African fevers than we did in the open country between Mataddi and Stanley Pool.

"A long halt in the forest-clearing soon reminds us that we are not yet so acclimated as to utterly escape the effects of malaria. But when within the enclosed wood our agues are of a very mild form, soon extinguished by a timely dose of quinine.

"If there is a thick screen of primeval forest between the dwelling-place and a large clearing or open country, there is only danger of the local malaria around the dwelling, which might be rendered harmless by the slightest attention to the system; but in the open country neither a house nor a tent is sufficient protection, since the air enters by the doors of the house, and under the flaps and through the ventilators, to poison the inmates.

"Hence we may infer that trees, tall shrubbery, a high wall, or close screen interposed between the dwelling-place and the wind currents will mitigate their malarial influence, and the inmate will be subjected only to local exhalations.

"Emin Pasha informed me that he always took a mosquito-curtain with him, as he believed that it was an excellent protection against miasmatic exhalations of the night."

The relief that we feel when breathing the air within the forest, as compared with the irritation often experienced outside of the forest, is undoubtedly due both to the purity of the forest air, together with its higher relative humidity, in which respects the forest and the ocean air resemble each other.

A remarkable collection of facts, relative to malarial fevers, is given by Dr. H. M. Clark, of Amritsar, India, in the last number of the *Scottish Geographical Magazine* (Vol. IX, p. 281). Dr. Clark's experience in India justifies him in stating that the planting of trees is a measure of special hygienic importance. Belts of trees judi-

ciously planted are of the greatest service ; not only do they screen and shade the soil, thereby keeping it cool and preventing the development of the germs, but they intercept the poison and act mechanically as preventive agents. The tall, stately forest trees with dense foliage are undoubtedly the best ; those having thin crowns are unsuitable. The shade-bearing trees with dense crowns are those that effectually screen from malaria-laden winds, intercept the rainfall, and protect the earth from the sun. In this respect the Indian fig or banyan, the peepul, the mango, and especially the plantain or banana trees, are remarkably efficient. These general conclusions, especially applicable to India, may well apply also to the United States.

The forests, therefore, act to diminish malaria :

1. By shading the soil so that its coolness prevents the growth of malarial bacteria.
2. By diminishing the wind at the level of the soil and thus preventing the spread of bacteria.
3. By sifting the wind through their leaves the trees catch the germs or delay their progress and give them time to settle to the ground, thereby protecting localities to the leeward.
4. Facilitating the formation of fog at night-time, by which the germs are carried down to the ground and the air purified.

From a hygienic point of view reforestation promises to be of great importance to the nation. We may, by studying eastern countries, see at once what we shall come to if we omit or neglect this process. I suppose that the planting of a forest in a malarial region does really diminish the tendency to disease, as has been so often maintained, and, in accordance with what I have just said, I should explain this efficiency as due, not to drainage nor to the absorptive powers of the eucalyptus nor to the anti-malarial influence of the sunflower, but to the fact that the forest covering shades and cools the soil to such an extent that the cool earth is no longer capable of developing the injurious forms of protozoa and bacteria. A soil that is alternately warm and cold, dry and wet, as is the case in the open fields, presents the best conditions for the development and dissemination, by the winds, of these microscopic germs. Carried to great distances by the wind, they settle in the water that we drink, and the food that we eat ; they are inhaled into the lungs ; they alight on every open sore or cut ; they slip into the eyes and into the ears ; they besiege us from the time that we are born until they have brought us low in death. Panting for a breath of fresh

air and for respite from their influence, we take a long sea voyage, or we welcome the great areas of purer cold air that come down to us from the upper regions as cold waves, or we sniff the fresh air after a rain or snow storm has washed off the atmosphere, and say, "How delightful!" In many ways man shows his innate hatred of dusty air; he seeks for fresh air by a few days on the mountains and in the woods; he chooses his dwellings on the windward side of the city, and, if possible, among the trees; he pays higher prices for the woodland than for corresponding open fields; he plants wind-breaks between himself and the winds, or anti-malarial groves between himself and the marshes. By his acts, if not by his theories, he recognizes the principle that the forest is essential to health and happiness.

Man must till the ground; some portion of the forest area must be cleared and cultivated. The forest soil that was so useful as a holder of water, the trees that were so graceful for food and foliage, the forest that was so beautiful to the æsthetic man, the playground that was frequented for recreation, must be demolished; but at what a fearful sacrifice, when we thereby stimulate the development of injurious bacteria and rob ourselves of pure rain and water.

A soil once cleared, drained, and cultivated may, after a while, become innocuous, but experience shows that in less than a hundred years after the removal of a forest the fertility of the soil has greatly diminished; the rains have washed away three-fourths of its nitrogenous ingredients; the hot sun has dried up and the storm winds have carried away another portion; the crop that is cut by the farmer has robbed the land of its small portion, and the land has become barren unless the most energetic artificial methods have been used to replace this loss. From this time forth the one simple and natural remedy is to return that land to its forested condition as rapidly as possible. Afforestation is an absolutely necessary sequel to deforestation. There must be a rotation of these two conditions, century in and century out, just as systematically as in the annual rotation of the ordinary grain crops. Every acre that is not needed for agriculture must be immediately planted and converted into forests if we would manage our territory on the most economical and rational system.

RELATION OF FOREST COVER TO WATER-FLOW.

By M. C. READ, Hudson, Ohio.

[Read at World's Fair Congress, October, 1893.]

The peculiarities of climate and the amount of rainfall are the important factors in determining the character of forest growth. To what extent the forests react upon the climate and modify its character is in most respects a disputed question. In this country it is not yet determined whether the extensive destruction of the forests has affected the amount of rainfall, but a very slight observation suffices to show that it has had a very important influence on the disposition of the rain-water after it has fallen. This influence can be learned as readily from the study of the character of the forest cover as it can from the visible effects of its removal.

A typical forest is not a mere aggregation of timber trees, and such wooded areas have only a moderate influence upon the disposition of rainfall. The dense undergrowth of shrubs, vines, and herbaceous plants are of prime importance, as well for the good of the forests as for its climatic influence. I have, in several instances, known of farm-forest reservoirs being completely destroyed by cutting out this undergrowth, regarded as useless, for the purpose of promoting the growth of the valuable timber, and securing the growth of grasses, so as to enlarge the pasturing area of the farm.

The forest areas of the northern and eastern States of the Union were generally of this typical character. In the swamps there was an almost impenetrable undergrowth of shrubs and herbaceous plants, and beneath them often a thick carpet of sphagnous moss. The uplands and hills carried a thick growth of large timber with a tangle of shrubs and vines and a smaller growth of herbs beneath, while the mountains were covered with a dense growth of smaller trees and shrubs pushing their roots into all the crevices of the rocks, which were too thinly covered with soil for the support of trees, but were generally covered with mosses, in which the roots of small shrubs and herbs found a foothold.

In all these areas the falling leaves were retained in the places where they fell, constituting a thick mulch, and by their gradual decay adding an annual increment to the soil.

Under such conditions, except when the ground was frozen, the heaviest rainfall would not cause a flood. The larger part of the water was retained in the place where it fell until it sank into the soil beneath, descending until it reached an impenetrable rock or clay stratum, along which it flowed until it found an outlet in various springs at a lower level. These springs were mainly the sources of the small streams, which, uniting into larger ones, found their way into the swamps, where their onward flow was checked, where they were spread out over the large surface of the swamps and the lakes and ponds usually connected with them, giving time for a large part of the water to sink into the strata below. The drainage was largely subterranean. The mass of the water in the streams was derived from springs from successively lower and lower elevations, keeping the flow nearly uniform and the water practically clear and limpid, as there was substantially no erosion or wash of the surface soil even in the hilly and mountainous regions. The streams were fed with filtered water. This has now all been changed; much of the change has been necessary and inevitable; some of it unnecessary and improvident.

The first work in the interest of agriculture was the destruction of forests. This was generally commenced on the dry land with a gentle surface drainage, and accomplished by cutting and burning the underbrush and timber, or on oak land by cutting and burning the undergrowth, and girdling the oaks, leaving them to die and gradually go to decay. These modes were not as wasteful as would now seem, as there was no market for lumber, and there was a marked advantage in returning to the soil as much as possible of the forest growth. On this kind of land the removal of the timber had at first but a slight influence on the surface drainage. The large amount of vegetable matter made the soil porous and absorbent, so that it received and retained most of the rainfall. As the roots decayed they left a net-work of subterranean channels which carried the water down to the subsoil and away beneath the surface. After years of cultivation these cavities became obliterated, the soil compacted, and the farmers were surprised to see land, formerly free from surface water, now so wet as to be almost valueless for tillage. In this condition the water was retained upon the surface until the depressions were filled and then largely flowed off into the neighboring streams, commencing that erosion of the soil which has given a muddy character to the water. The only remedy is through underdrainage, by which the capacity of

the soil to absorb and retain the rainfall is greatly increased. Gradually the deforesting was carried to the hills and the slopes of mountains, where the evil results were still more apparent. Deprived of the forest cover, these slopes carried off the water as from the roof of a building, which eroded the surface, washing away the soil, in places, to such a depth as to render the land worthless and make reforestation impossible.

After this the swamps and the lakes connected with them, the natural regulators of the streams, were attacked; the swamps were cleared and ditched; the outlets of the lakes deepened and straightened, until surface drainage was rendered as complete as possible. The results are everywhere apparent.

I write particularly in regard to Ohio, with which I am best acquainted, but extensive observations in other States indicate the same results. A multitude of springs which were once permanent have disappeared; others are intermittent and go dry in a drought. Very many wells have been deepened to secure a constant supply of water; streams once perennial are now alternately flooded and dry; those once flowing with clear pure water are now, during all or most of the year, muddy. One steaming down the muddy Ohio wonders why the early French explorers called it the beautiful river; but Mr. Samuel S. Forman, in describing a trip on a flat-boat down the Ohio and Mississippi in 1789, describes the water as "clear and limpid," in graphic contrast with that of the Mississippi. At that time one of these streams drained a region almost entirely covered with virgin forests; the other mainly a treeless region; in one, erosion was at a minimum; in the other, at a maximum.

This carrying away of the rainfall by surface drainage instead of its being filtered through the soil has another very deleterious influence, the consequences of which can hardly be overrated. It robs the soil to a very great extent of its elements of fertility and dumps them into the ocean.

A full remedy for all of these evils is not easily found; they may partly be obtained by reforestation the poorer lands among the hills and mountains, at the heads of the streams, and maintaining them permanently as forest reserves. This reforestation can in most cases be secured through natural agencies. If the remaining forests are secured from the intrusion of domestic animals, and forest fires prevented, nature will soon clothe large areas, now nearly naked, with new forests.

In northern Pennsylvania are many thousands of acres which the

lumbermen have stripped of valuable timber and abandoned ; much of this has been or will be forfeited to the State for unpaid taxes ; much could be bought for a very small price.

In many places where the pine and hemlock have been removed a dense growth of black cherry has taken its place. In all places a new growth spontaneously appears which only needs protection to grow into a new forest. If all these lands were owned and controlled by the State, and made permanent forests, an important step would be taken in remedial measures.

Another step would be the thorough and systematic underdrainage of all ordinary farming land. It has been claimed that this increases the flow of water from the land, but this is certainly a mistake. While it prevents the saturation of the surface, it greatly increases the capacity of the soil to absorb and retain the water, and regulates and retards its overflow. After heavy rains the outflow from the exits of the drains is not immediately resumed, and this outflow is continued long after the surface flow has ceased. The outflow from the drains is clear and limpid, having the character of spring water, and carrying away none of the fertilizing elements of the soil. Both in wet and dry seasons the productive character of the soil is much improved.

In the distant future, and before the evil days prophesied by Malthus are upon us, the surplus rainfall will be largely retained in reservoirs and in cisterns connected with the draining tile, and used for irrigation during periods of drouth. The equivalent of a cistern $6 \times 6 \times 8$ feet for each square rod would have a capacity equal to one-third of the annual rainfall, on an average, in the whole region east of the Mississippi. Such cisterns could now be profitably constructed on small farms devoted to truck-farming.

If most of the reclaimed swamps were reforested, the gain to the public would be large. Along the divide in Ohio, which separates the waters falling into the Ohio and the lake, are many such swamps, which were formerly lakes, and are now generally connected with a chain of lakes and ponds. Under the present system these lakes are gradually filling up and will ultimately disappear, and these natural regulators of the streams be entirely destroyed.

These reclaimed swamps are so valuable for agricultural purposes that they will be long and perhaps permanently retained for this use. The abandonment of the culture of our most productive lands cannot be easily secured ; such abandonment can be secured only by the substitution of some more profitable use. If these

lakes were needed as reservoirs for canals, the abandonment of the cultivation of the so-called swamps would be compelled.

If the experiment was tried of erecting dams at the outlet of any of these lakes, so enlarging them as to cover the adjacent swamps, devoting the enlarged lakes to the artificial culture of fish, and this experiment was found successful and profitable, the experiment would be repeated and all these lakes and swamps would be ultimately redevoted to their natural uses.

To secure any of these conservative measures the aid of the Government is almost if not quite indispensable. To secure this aid appeal must be made to one of the most important functions of government, which is now scarcely recognized, anywhere, by the government or the people. It is to require every one to recognize and obey the admitted maxim of the law "so to use his own as not to injure others," and including in the word "others" all who are to come after him; to recognize the fact that the present generation are only the life-tenants of a magnificent heritage, which they are required to leave to their descendants with its productiveness unimpaired. Whenever the present use seriously threatens future productiveness it is the duty of government to interfere and prevent waste by the life-tenants. The theory of *laissez faire*, every one for himself and his sable majesty take the hindmost, is one of the doctrines of devils that ought to be quite obsolete. We should be required to leave at least as much to our posterity as we have received by inheritance, and government should compel the present life-tenants to do this. If the undue destruction of forests tends to interfere with the future value of the state, government should interfere to prevent it. If reforestation is in any places required to secure future productiveness, government should in some way secure it. If to this end the preservation of the forests anywhere is required, government should *compel* their preservation.

FORESTRY MATTERS IN NEW YORK.

By WM. F. FOX, Superintendent of State Forests.

[Read at World's Fair Congress, Oct., 1893.]

CONDITIONS.

Although New York is the most populous State in the Union, one-fifth of its area is still covered with woodlands of original growth; namely, of its 31,468,800 acres, over 6,000,000 are forest land.

These woodlands are not distributed throughout the State, but, a few small areas excepted, are massed solidly in two large tracts. The greater one of these, containing about three-fourths of the whole, is situated in northeastern New York, and contains the far-famed Adirondack wilderness; the other and smaller one is situated in the southeastern part of the State, and is known as the Catskill forest, this latter tract extending, strange as it may seem, to within an hour's ride of the metropolis itself. There are no other extensive forests except the scattered patches or belts of woodland which may be seen in any of the agricultural districts of the Atlantic States.

A large part of these forests, both in the Catskills and Adirondacks, have undergone a material change through the operations of the lumbermen. Though densely shaded and heavily timbered, the experienced observer notes that certain species are missing. Seventy-five years ago these woods contained a magnificent growth of white pine, which in clearness, soundness, and quality of timber was unsurpassed; but it was removed so completely that comparatively few traces of this species remain. Here and there clumps of tall pines may still be seen, but on examination they prove to be ring-rotten, or otherwise worthless, and were probably left by the axemen for that reason. Timber lots with good pine on them are now very scarce. At that time the lumbermen took the white pine only, spruce and hemlock having no value then. But the pine was cut so long ago that few traces are left of that period of lumbering; and now it is customary to call a spruce forest a primeval one, although a careful examination will show that perhaps fifty years ago the axemen went over this same ground in their quest for white pine.

So, to-day, the term "original or virgin forest" means, in the Adirondacks, a tract on which the spruce and hemlock have not been cut. The hard woods, owing to the fact that they cannot be floated down the streams, have been allowed to remain.

The merchantable species of the New York forests, in the order of their value, and quantity also, are, of the soft woods or conifers, black spruce, hemlock, balsam, tamarack, and white cedar, the thinning out of the forests and destruction in some cases depending on the presence and accessibility of these kinds. These conifers are mixed in varying proportions with the hard woods, but, for the reason already stated, the latter are not cut, except along the border of the forest, where they are easily accessible and can be hauled in-

stead of floated. The dominant species of hard woods in order of quantity are maple, birch, beech, ash, elm, and cherry, and in the Catskill forest there is considerable oak. Throughout the State, however, there are eighty-six species, not including tall shrubs.

The one merchantable tree mostly in demand by the lumbermen, and consequently the one most closely connected with forest conditions, is the black spruce. Its market value is less than white pine, but more than hemlock. Fully one-half the Adirondack forest has been cut over by the lumbermen in obtaining this species; at the same time, they cut the hemlock and the balsam as they go. These operations do not necessarily imply denudation, for the hard wood trees and some of the conifers are left; but the careless, improvident methods hitherto in use have, in too many instances, left the woods, where thus operated on, in a deplorable condition. In some places the mass of tree-tops, limbs, and brush have furnished material for furious fires, while in others the thinning out has been so great that the sun, wind, or rain has completed the work of destruction.

Until a few years ago the lumbermen, when cutting spruce, contented themselves with taking only the larger trees; but with a growing scarcity of timber and increased demand they cut smaller and smaller, until eight-inch butts and six-inch tops formed a conspicuous proportion of every log drive. This was bad enough; but with the advent of the wood-pulp industry they found a ready market for four-inch timber, and cut accordingly. In this destruction of young spruces the State is confronted with a most serious condition.

In the forestry outlook for New York it has always been considered a happy condition that its forests contained so large a proportion of spruce, a tree so well adapted to reproducing itself; that, while other States in their forestry management would have to deal with hemlock and pine, both of which will each reproduce only under the most favorable conditions, New York possessed a merchantable species which, with ordinary care and little expense, would furnish a perpetual timber supply. Some of the timber tracts in the Adirondacks, with no forethought or care whatever on the part of their owners, have yielded a second and even a third crop of spruce. But with the unrestricted cutting of spruce saplings and young trees for pulp-wood, now prevalent on most all the private timber lands outside the preserves owned by the clubs, a most serious condition confronts every one interested in the forests of New York.

At one time it was a matter of congratulation that the lumbermen left the balsam (*abies balsamea*), deeming it unmarketable. Its symmetrical spires beautified the forest, while its healing odors gave new life to stricken invalids. But of late years it has been cut with the spruce, the lumber when sawed, though inferior, being hardly distinguishable. The white cedar, a tree also valuable for its terebinthine odors, is being cut with the others, being used for shingles and fence-posts. The hemlock, valuable on account of its bark rather than its timber, is being cut to a great extent wherever it is accessible. Unlike the spruce, this tree does not easily reproduce itself, observation showing that the nurselings seldom reach maturity in that region. The tamarack has suffered so extensively from a wide-spread blight that but little merchantable timber of this species is left standing. Still, a large number of young tamaracks are cut in some localities for hop-poles, and where the larger trees have not died many of them are cut for square timber or sawed into dimension stuff. In short, there is a demand for each kind of soft wood, and each kind is being cut.

But little hard wood, comparatively, has been removed. On the borders of the Adirondack forest about 10,000,000 feet is being sawed annually, the logs being hauled to the mills. A large amount of hard wood is also cut in the Catskill forests for the furniture trade, the manufacture of wood-acid, and various other purposes.

In 1890 the mills along the edge of the Adirondack forest sawed 325,690,634 feet, of which 210,270,932 feet was spruce and 94,145,695 was hemlock. The pulp-mills in 1892 consumed over 100,000,000 feet of timber, all spruce, and mostly small young trees at that. It is evident that, unless this consumption can be checked or regulated, the timber supply of New York will be exhausted in twenty-five years.

Another important condition exists in the continued encroachment through petty agricultural operations. The lands thus cleared might far better be left under forest cover. The soil is worthless for any other crop, and it would be a charitable work to prevent the misguided efforts in this direction. The lands thus cleared never repay the patient toil laid out upon them. But the objectionable feature of these operations is not so much the loss of wooded area as the forest fires which are apt to ensue from the fallow burnings started to clear the land. Fully 450,000 acres of valuable forest have been destroyed in this State within thirty years from this cause alone. One cheering feature of the present outlook is that

this prolific source of destruction has been substantially eliminated. At least, there has been but little loss of area from this cause during the last six years. As to how far this is due to fortunate circumstances, or to well-directed efforts on the part of the State Forestry Bureau, it would be difficult at present to say. Much of the credit is certainly due to the latter.

The Catskill forests are an unbroken tract of about 2,100,000 acres, situated on the mountain ranges from which they derive their name. They differ somewhat from the Adirondack forest in this, that the hard woods predominate to a much greater extent. The white pine disappeared from the Catskills fifty years ago. Then the great tanneries which located in that region made a demand for bark that cut out most of the hemlock. The spruce went for building purposes. There is some hemlock and spruce left, but of an inferior quality. It is substantially a hard-wood forest, but with a greater variety of species than the Adirondack land.

Another condition, and a peculiar one, is due to the railroads which traverse both forests, and which are responsible for many forest fires, started by sparks from their locomotives. The Adirondack wilderness is penetrated by four different roads, and in the last year a fifth one was completed which runs through the entire forest, north and south. Along the roads previously built the locomotives have started fires which have not only cut a wide swath along the whole line, but have eaten their way, in some places, a long distance laterally. The road last completed is carefully watched in this respect, as it is controlled by parties who own immense tracts of timber land immediately adjoining its line. Still, if it does not inflict serious injury on the woods along its route, it will be the first one that has not. The Catskill forest is also intersected with railways, and the annual reports from the fire wardens in that region teem with complaints of fires started by sparks from locomotives. While it is conceded that railroads are a valuable adjunct in marketing forest products, it is doubtful whether they are a benefit to a communal or State forest unless operated under the forest government and for forestry purposes mainly.

In discussing here the more important conditions, mention may be properly made of the State government in its relation to forestry matters. The State owns 677,220 acres in the Adirondacks and 48,491 acres in the Catskills—a total of 725,711 acres, which have been set apart by law as a forest preserve. These lands, for the most part, reverted to the State through the non-payment of taxes,

a very small proportion having been obtained through purchase. Eight years ago the care and management of these lands was vested in a State bureau styled the Forest Commission, an honorary board of five members, selected with reference to well-known integrity and ability, who serve without pay. Under them there is a superintendent of forests, with the necessary corps of assistants, inspectors, and foresters. Hitherto the administration of the Commission has necessarily been confined to a police management, looking merely to the protection of the State forests from fire and timber thieves. Owing to the scattered condition of the State holdings and insecurity of title, no definite system of improved forestry could be prudently undertaken.

Mention should be made, in this connection, of the numerous clubs which own large tracts of woodland within the line of the Adirondack Park, these corporations, large and small, owning about 550,000 acres. This condition is a highly favorable one, as the existence of the clubs, their aims and purposes, are dependent on the preservation of the forests which cover their lands. Three of these clubs, or associations, own over 100,000 acres each, or a total of about 390,000, all fine timber land, containing more than the usual proportion of merchantable species. While holding these as game preserves and summer resorts, they sell timber rights in some instances, but under restrictions which prevent any serious injury, the restrictions specifying the species and size of timber that may be removed.

PROBLEMS.

After years of careful study of the situation, made on the ground itself, the conclusion is forced that there are two things for the State to do. It must acquire substantially the entire territory within the boundaries of the Adirondack Park, and then inaugurate an intelligent system of forestry based solely on the question of a future and perpetual timber supply. All other matters are subordinate, and any discussion of them is merely time lost. If the State will push steadily along on these two lines, the other questions will solve themselves without further care.

But why purchase the entire territory? it may be asked. Because the preservation and future existence of that forest in its entirety is dependent on communal instead of private interests. The former is unchangeable in its character; the latter is not. A communal interest is based on perpetuity of title and on a management looking to the future rather than the present. A private

interest means successive changes in the title, and a management based on present needs.

There are large tracts, held by clubs or individuals, whose management indicates that their forests will be preserved during the present ownership. But it is only a question of time when these lands will pass into other hands and be managed with reference to pecuniary needs.

Now, if the State acquires the territory, its management, however lax or open to criticism, will never fail through stress of such a motive. State ownership will insure forest preservation, even it fails to secure an improved forest and an increased product. Private ownership cannot insure forest preservation, because of its changing tenure.

The 677,000 acres of State lands within the Adirondack Park were acquired through tax sales, and consequently are scattered so widely throughout the private holdings that no improved system of forestry can be attempted. The remaining forests through which these lands are interspersed should be bought, or else the whole forestry project should be abandoned. The movement should be forward, not backward. Which shall it be? To merely stand still; to be contented with holding the lands now owned, and paying taxes on them, as the State is now obliged to do; to maintain an expensive bureau while progress is impossible, is worse than idleness—it is retrogression.

The State must buy more land to consolidate its present holdings, which are scattered over the map like the squares on a checker-board. In providing means to purchase additional lands, a sufficient amount should be appropriated to complete the purchase of the entire forest within the limits of the Adirondack Park. While the press, people, and State government favor the acquisition of these forests with a remarkable unanimity, time has been lost by looking toward futile and evasive measures instead of boldly approaching the matter in the one, the right, and the only way—by purchase. Some friends have looked for further acquisitions through tax sales; but the agitation of the forestry question has enhanced the value of woodlands in New York until there is no more reversion of land through defaulted taxes. Some have depended on controlling improvident timber-cutting by offering exemption from taxes, a law having been passed to that effect; but the land-owners reject the offer of tax exemption, preferring to cut their timber as close as they please.

There remains only one thing for the State to do: if it wants that land, it must do as individuals do when they want land—the State must buy it.

And there should be no hesitation about buying it. A State that can afford to put \$20,000,000 into one building can afford to vote one-fourth that amount to preserve its forests. Money paid for these forests is not an expenditure; it becomes a first-class investment. The lands can be sold at any time for cost, and in the meanwhile they will produce a revenue more than sufficient to pay the interest on the bonds issued for their purchase.

Many advocate the condemnation of these lands; but condemned lands must be paid for, and the money must be appropriated by the legislature the same as for purchases. To seize land by right of eminent domain is a harsh and unpopular measure that should be held only as a last resort. Moreover, the bulk of the land can be bought, through the ordinary methods of bargain and sale, at prices less than the land would bring under appraisal. Appraisers always give the benefit of a doubt, and justly so, to the man whose land is condemned.

A large fund for the purchase of land will soon be available through the operation of the law of 1892, which authorizes the sale of scattered, outlying tracts, situated so far from the main forest that they cannot be used in connection with any well-defined plan of operations. This law directs that such sales shall constitute a fund which may be used only in the purchase of lands situated within the Park boundaries. These outlying tracts, owing to their accessibility, bring high prices, which enables the Commission to not only locate their land to better advantage, but to increase the acreage.

After the outside lands have been sold and the proceeds invested within the Park lines, the area yet to be purchased can be definitely ascertained. The legislature will then be asked to authorize an issue of bonds to be used in purchasing the remaining area.

This, then, is the one great problem to-day—the further acquisition of land. Fortunately, the attitude of the State government is a favorable one, and the legislature grants annually an ample appropriation for the maintenance of the Forestry Department and its work. The Governor of the State, Hon. Roswell P. Flower, is deeply interested in the forestry movement, and fully appreciates its importance. He supplements his study of the various questions with a personal inspection of the forests and extended trips through the

wilderness in search of information bearing on the various matters connected with the subject. He gave his personal attention to the forestry bill passed last winter, and originated some of the more important amendments. His sturdy and valuable support is the most cheering feature of the outlook.

But the legislature, in considering the propositions looking to an appropriation or issue of bonds, evince a conservatism bordering on timidity, and are evidently reluctant about passing any bill which might raise the tax-rate in any noticeable degree. And it is right here, around this point of the tax-rate, that the whole matter revolves.

It may be, however, that with the funds accruing from the sale of outlying lands and from the sales of matured spruce the Bureau may be able to make purchases which will consolidate their present scattered holdings and give them about 1,000,000 acres of forest, which, though it may not be in one solid tract, will be favorably located and furnish an opportunity for inaugurating a better era in forest management.

There are other problems which have occasioned considerable discussion and study; but they are technical ones, and a rehearsal of them here might not be timely, for lack of space. They involve the questions of thinning, reforestation, and protection of denuded hillsides.

Throughout the State preserve there are some tracts which have been burned over, and which are covered with the aspens* and bird cherries† which, in the Adirondacks, invariably follow a fire. These aspens, or poplars, are fast growers, becoming available for pulp-timber in a few years, and should be sold then, as they are a very short-lived tree. Problem: how to thin out so as to get the greatest yield, and, at the same time, promote the advent of the spruce and other conifers, which always appear before the poplars die off.

Again, there are areas which have been burned over repeatedly, until even the poplars fail to appear. Problem: what species can be planted and grown successfully under such unfavorable conditions?

Again, there are mountain slopes denuded by fire or cyclones. Problem: how shall the charred and fallen tree-trunks be best arranged so as to prevent the loose soil from being washed away,

* *Populus tremuloides*.

† *Prunus Pennsylvanica*.

and hold it in place until nature can do the work of reforestation? There is a fine opportunity for an experiment in this line on the east slope of Whiteface; and as soon as the State purchases this land the experiment will be undertaken.

But a full statement of the conditions and problems connected with the New York forests would require a volume. Suffice it to say here that perplexing and confusing as those conditions and problems are, that despite errors, disappointments, and delay, forestry matters in New York are moving, and in the right direction. It will not be long before results will be attained worthy of that great State, and satisfactory, it is hoped, to the American Forestry Association, to whose untiring efforts in arousing public sentiment the forestry movement in New York owes its inception and existence.

THE FORESTRY PROBLEM IN PENNSYLVANIA.

By J. T. ROTHROCK, State Forestry Commissioner.

[Read at World's Fair Congress, Oct., 1893.]

The State of Pennsylvania, long one of the most important lumbering Commonwealths of the Atlantic seaboard, may be said to have passed the zenith of its prosperity in this particular interest. It is true that it still produces considerable white-pine lumber each year, but it is also true that the increased quantity of hemlock cut, as compared with white pine, shows clearly to those familiar with the facts of the case that the original growth of the latter is almost gone. Over a large portion of what was once the seat of extensive operations in both white pine and hemlock the chief—indeed almost the only—lumbering trade now is in jack and yellow pine, so called by the Pennsylvania woodsman. These smaller trees are, year after year, being taken to meet the increasing demand for mine props. Tram roads are extending constantly into regions which have hitherto been inaccessible, and now branch railroads are placing a premium upon the removal of timber which up to this time could not be removed at a profit to the owner.

Much the same may be said of the various hard woods. It is probably correct to say that if any kind of timber is being reproduced within the limits of the State of Pennsylvania as fast as it is removed, it is chestnut, and that alone.

That this should be the case is unfortunate, but it was unavoid-

able, because, first, the timber cut has been expended in legitimate trade, or it was removed to make room for farms before the present railroad facilities for travel invited the home-seeker to more productive agricultural regions in the remoter west.

Accepting the facts, the important question is: What is the remedy?

This question is too broad to answer fully here. It is safe to say, as a necessary preliminary, that each family must in future be content with less land for farming purposes, and that the lesser area must produce better crops under better cultivation, and that economy, and not extravagance, must dictate the quantity of wood used hereafter.

Under any conditions, however, a large portion (area yet undetermined) of the State can never be used to advantage for any other purpose than the growth of timber—agriculture being wholly out of the question. On such parts the care and culture of timber must be insured by one of two methods, *i. e.*, State ownership, or by making it profitable to individual or corporate enterprise.

Whilst it is true that a certain portion of these lands will almost inevitably pass under the control of the State, it is equally certain that the larger portion is likely to remain as private property. Hence any solution of the problem must be broad enough to meet both State and private ownership.

At the outset, let it be said that the tendency to reproduction of timber of all the native kinds by natural methods is very strong in Pennsylvania. The thrifty groves of young white pine, for example, show this most clearly, for it, of all our trees, was regarded as the one whose continued preservation was in greatest jeopardy.

The one greatest foe to this reproductive tendency is the unchecked forest fire, whether the land is owned by the State or by the individual. Hence it goes without saying, that a remedy here is of the first importance. It is not physically impossible to check it, though it may be for a certain time, until public opinion is more matured, impossible to obtain the most effective legislative aid. Money and legal enactments combined would do it if both could be obtained to the desired extent. But to press at once for either or both of these on the basis of the greatest efficiency would be to arouse hostility, which would long postpone the desired end. There must be a wise conservatism, which will carry conviction before each increasing demand. What may be done in a moderate, practicable way?

1st. Woodlands are often fired to destroy underbrush in order to furnish pasturage or better browsing for cattle. This part of the problem could be easily met by the confiscation of all cattle found on other woodlands than those of the owner, unless they were there by his permission.

2d. Woodlands are often fired, maliciously, to injure the owner, or (which is hardly less criminal) to clear underbrush, and thus lead to production of a larger crop of berries. In such cases there seems to be no remedy short of the appointment of special State officers, whose business shall be to ferret out the offender, by individual search, or by this combined with a liberal system of rewards leading to the detection of the criminals, and by punishment of the guilty parties, by the State. It is hardly safe to leave this to a local tribunal, and, as the benefits of the forest extend to the State at large, the State, which suffers, should hold the power of punishment.

In this connection it may be said that the plan of calling out aid to suppress fires, and then paying the laborers, has been fairly tried in portions of the State, and that the results have not been satisfactory. Whilst one party was engaged in extinguishing fires, others were engaged in starting them. The compensation clause, in other words, has led to producing fires as a means of obtaining work. It would, however, be premature to say that there is no legal remedy for this condition of affairs, but that the difficulty is at present a serious one is beyond dispute.

3d. Among the causes of forest fires in Pennsylvania, railroads must be counted as most active, as, indeed, they are everywhere. Where the fire can be clearly traced to a passing train, there is, of course, a legal compensation. But to fix the fact is seldom easy, and the sufferer who seeks the assistance of the law is frequently, if not usually, beaten in the contest. Two remedies appear: one is to compel the railroad companies to employ a sufficient fire guard to protect the forest lands through which their lines pass. This might lead to greater care in furnishing locomotives with efficient spark arresters or consumers. The other remedy would be to compel the companies to purchase land for, say, a rod on either side of the road-bed in wooded areas, and to keep it clear of combustible material. Whether either of these remedies would prove practicable at present would depend on the relation of the railroads to the legislature, and here somewhat uncertain elements are introduced.

4th. Debris left after lumbering operations is a most prolific

cause of fires of the most damaging character. It is well known that when this has been consumed subsequent fires are less destructive, because so intense a heat is no longer possible. It is then in order to indicate that those who create this debris should remove or destroy it by some safe method. But the remedy so proposed would meet, it is clear, as yet with so sturdy an opposition that it is probably impracticable. So, too, the maintenance of "fire lanes" through our timbered areas would involve a cost for which our legislators are not as yet prepared.

Hence it is of the utmost importance that agitation of the forestry problem should yet be continued, to mature public sentiment in the proper direction.

The second most serious factor in the forestry problem is the tax upon timber land. There can be no doubt but that the sentiment in favor of total abolition of tax on all standing timber is maturing very fast in our State. There are, however, two difficulties in the way. First, the constitutional clause which demands equal or proportionate taxes on all property within a certain class. This might be obviated by making forest lands a class alone.

Then, again, a second difficulty arises when we remember that certain sparsely populated counties derive their tax income in great part from forest lands. To remove this tax would be to such counties a serious loss, if it did not, indeed, actually hinder their proper development. Take, for example, the maintenance of proper roads, which now depends largely upon this very tax. There is, of course, this to be said, that the day is probably not far distant when these roads will become the care of the State instead of the township.

The tax aspect of the problem merits a more extended consideration. It can be shown that there are extensive woodland areas in Pennsylvania on which in the past thirty years more tax has been paid than the lands could be sold for to-day, and that during this entire term of years the lands have been wholly unremunerative to the owners. It is clear that such lands have been practically confiscated by existing laws. Can we wonder that under such circumstances the owner should be driven to remove immature timber in order to realize what he could, and then, often, to allow the lands to be sold for a nominal sum to meet the taxes? To be sure, this may, in some instances, be the gain of the State; but more frequently it is just the reverse. Let us imagine for a moment that the taxes had been removed. The owners would realize that here,

in their timber, they had a property which was growing into value, however small, without actual outlay to them. Neighbor would join with neighbor to protect it against the only serious foe—fire. To guard it would become a concern of the community; the incendiary would speedily find himself placed in a light in which he had never stood before. To fire a forest would become a thing of as bad repute as to steal a horse, and protective associations would be formed to guard against the former, such as already exist to guard against the latter. The writer is not drawing upon his imagination in this aspect of the problem, for he has good reason to know that such associations are already being considered by those who are most deeply interested.

Let us consider the tax question from another standpoint—that of equity. We are told the forests are growing into value, and that the owner will hold them with this object in view. Grant the full force of this statement; is it not true that every day a forest stands it is earning its living in the good it is doing the Commonwealth by retarding freshets and hoarding water? Or even admit in its baldest form the truth of the statement that they are growing into value for the owner. Is it not equally true that this is the most desirable thing possible for the Commonwealth as well? Has it not become, in certain parts of the world, a maxim of political economy, that the forests are as necessary to the State as to the individual? Take our larger cities! Whence comes the best water which supplies them but from the higher, timber-clad slopes of distant regions. This indispensable element, this hourly necessity, they pay actually nothing for the production of until it reaches their own suburbs. A readjustment of taxes might make it possible for these cities to furnish under State distribution the means by which sparsely populated counties could be developed, even if the tax had been taken from their timber lands.

It has been suggested by some thoughtful persons that, instead of removing the tax from timber lands as a whole, it would be well to retain it *on all unseated timber lands*, but to set apart that tax for the specific purpose of employing wardens and workmen whose duty it should be to protect these lands from fires. There is much in the idea to commend it to a most careful consideration. The chief obstacle seems here, again, to be the constitutional one of discriminating taxes within the same class of property.

There can be in this country no genuine, practical forestry developed until the owner is made to realize that in his trees he has a

paying crop. When this idea has taken possession of him, all the rest will follow. If he fails then to discover methods by which this crop may be produced in largest measure and in the least time, it will be the first instance in which he has been known to fail in that direction. It is time for us to realize that an analysis of the elements of the forestry problem will show we do not have everything to learn. That, indeed, in some phases of forestry, we are already well up, and it is barely possible that we could develop, for most of the remainder, methods of our own as speedily as we could adopt those from abroad. I trust I shall not be misunderstood in this allusion. No man honors more than I do the science of forestry as exhibited in Europe, but I also insist that it is full time for us to assert the individuality associated with national life, law, and with a change of latitude. I am convinced that what we chiefly have to become proficient in is the mere planting and care of trees on a large scale. The engineering, the removal of trees, and the care of lumber are already well known. And be it observed that in these very points our foreign brethren are often greatly at variance with each other. With game laws and game preservation we are not concerned at present, and probably never will be. The relation of trees in producing fertility of soil, tempering climate, and to water supply are scientific problems of the greatest interest, but they are not factors in the practical restoration of forest resources. It is, however, greatly to be desired that special experts should be induced to lend their aid in placing these problems on a proper basis, and that we should contribute our share towards the world's stock of knowledge concerning them. But this, I repeat, is an aspect with which we are not necessarily practically concerned just now.

There are, however, certain aspects of the forestry question in which we are immediately and practically interested, and which relate specially to our own side of the Atlantic. I mean the rates of wood production, the time of wood maturity, and especially how both these, and the quality of the timber as well, are affected by soil and exposure. I am convinced these are problems which we must settle here for ourselves. And they bear directly upon the economic side of the subject. For example, it would be most important to determine by observation here what is the actual average yearly wood production per acre. It is quite clear that many whose opinion seems entitled to respect, and whose opportunities for observation have been large, place the figures higher than a trans-

atlantic forester would admit as probable. There are also certain ratios of increase for the individual tree at different periods of its life, which possibly may be tabulated, and which involve practical considerations of vast importance.

Among the trees which deserve the special attention of the Pennsylvania forester is the white pine. In so far from being a tree of difficult reproduction, and which, therefore, is tending to extinction, the exact reverse is the case. Over a large part of the area on which it once grew it is now growing luxuriantly and spontaneously. More than any other important tree of native growth, except the chestnut, it grows with an even rapidity. It would be safe to say that in from sixty to sixty-five years one may expect a tree whose diameter at two feet above the ground will be from eighteen to twenty-four inches. There are, of course, notable exceptions. Some trees, for example, whose history we know, have fully doubled this rate of growth; others have fallen proportionately as much below it.

A striking exception to the above statement is found in the fact that out of a large number of matured white pine trees growing side by side, and apparently of about the same age, some will reach a diameter of four feet across the stump, and others possibly not more than half as much. This was well shown in Centre county (Pennsylvania), where the age of the grove alluded to was about two hundred years. It should also be mentioned that the growing white pine of to-day is found, as that of the primeval forest was, in "patches." It is not evenly distributed, even on areas where it grows naturally. This very simple fact, clear to all observers, is of value chiefly to show that the altered environment has not in any way disturbed the natural method of reproduction, and that the essential element in the restoration of this tree is simply what it always has been—time.

The term "sap pine" as used in connection with the white pine has almost come to indicate that it is essentially different from the fine, soft, clean lumber of earlier days. This error, which is perpetuating itself, is mischievous, because it encourages the premature destruction of trees which are actually growing into the most desired condition of white pine.

After years of agitation, forestry legislation of a satisfactory character was obtained at the last session of the legislature. The bill as finally passed is here introduced. It will be observed that it aims at two things: first, to ascertain the real condition of our

forest resources, what the possibilities of the future are, and then with the preliminary data at hand to endeavor to inaugurate a positive comprehensive forest policy, or something as near to it as our legislature can be induced to grant.

No. 68.

AN ACT relative to a Forestry Commission and providing for the expenses thereof.

SECTION 1. *Be it enacted by the Senate and House of Representatives of the Commonwealth of Pennsylvania in General Assembly met, and it is hereby enacted by the authority of the same,* That the Governor be authorized to appoint two persons as a commission, one of whom is to be a competent engineer, one a botanist, practically acquainted with the forest trees of the Commonwealth, whose duty it shall be to examine and report upon the conditions of the slopes and summits of the important watersheds of the State, for the purpose of determining how far the presence or absence of the forest cover may be influential in producing high or low water stages in the various river-basins, and to report how much timber remains standing of such kinds as have special commercial value, how much there is of each kind, as well, also, as to indicate the part or parts of the State where each grows naturally, and what measures, if any, are being taken to secure a supply of timber for the future. It shall further be the duty of said commission to suggest such measures in this connection as have been found of practical service elsewhere in maintaining a proper timber supply, and to ascertain, as nearly as is practicable, what proportion of the State not now recognized as mineral land is unfit for remunerative agriculture and could with advantage be devoted to the growth of trees.

SECTION 2. The said commission shall also ascertain what wild lands, if any, now belong to the Commonwealth, their extent, character, and location, and report the same, together with a statement of what part or parts of such lands would be suitable for a State forest reserve, and further, should the lands belonging to the Commonwealth be insufficient for such purpose, then to ascertain and report what other suitable lands there may be within the State, their extent, character, and value. The final report of the said commission shall be presented to the legislature not later than March fifteenth, one thousand eight hundred and ninety-five.

SECTION 3. The said commission shall have power to appoint one competent person to act as statistician, whose duties shall be to compile the statistics collected by said commission under their direction and supervision, whose salary shall be one thousand dollars per annum, with necessary expenses to be paid in the same manner as is hereinafter provided for the payment of the Forestry Commission.

SECTION 4. The commissioners appointed hereunder shall be entitled to receive, by quarterly payments, a compensation as follows: The engineer, twenty-five hundred dollars (\$2,500) per annum; the botanist, twenty-five hundred dollars (\$2,500) per annum, with necessary expenses for each, and the sum of twenty thousand dollars (\$20,000), or so much as is necessary, is hereby appro-

priated out of any money in the Treasury not otherwise appropriated to be paid by warrant drawn by the Auditor-General.

Approved, the 23d day of May, A. D. 1893.

ROBT. E. PATTISON.

The foregoing is a true and correct copy of the act of the general assembly, No. 68.

SECRETARY OF THE COMMONWEALTH.

FOREST CONDITIONS IN THE NORTHWESTERN LUMBER STATES.

By C. H. PUTNAM, Eau Claire, Wisconsin, Vice-President American Forestry Association.

[Read at World's Fair Congress, October, 1893.]

By the Northwestern Lumber States we mean the States of Michigan, Wisconsin, and Minnesota, bordering on the great lakes, which have been the base of supplies for pine and hard-wood lumber for the past forty or fifty years, and without which the vast and rapid settlement of the adjoining prairie States of Illinois, Southern Wisconsin, Iowa, Minnesota, and even Eastern Dakota, Kansas, and Nebraska, might have been almost impossible, or very much retarded; so that we may say those three forest States have made the development of the prairie States possible, and we may also add that the States named are interested, in a great measure, in the perpetuation of said forests, for they are still the base of timber supplies. Another important factor to the prairie States is that these same forests, if properly cared for and preserved, will be the guardian angels over floods and water supply on the Mississippi river and its thousand tributaries, to save the disasters of spring floods, hold back the snows, and thus secure an even and timely flow of water through the season.

The writer for the past thirty-seven years has travelled extensively in the States of Wisconsin and Minnesota, observing the forests, streams, and watersheds carefully, and can truthfully say that if the said forest States become disproportionately cleared and bare, allowing the heavy snow and rainfalls to run off rapidly in the early spring, cities and towns and farms along the lower river could not exist where they are now located. I do not think people have

given this subject much thought—the preservation of forests at the heads of our main rivers.

It is a subject, however, that can be very easily studied in some parts of Europe, and in our own country; on the Potomac especially, where one can see a water rise of 25 or 30 feet, when within the memory of old settlers it did not formerly exceed 10 feet. Along its course, while once the old homes were in the valley and near the river, they are now on the higher land and the hill-sides; the forests along the river and at its head are largely destroyed, and the waters run off rapidly.

This digression is made, as it throws some light on the problems regarding the northwestern forests, and calls attention to the fact that a vast area outside of the forest areas themselves is directly interested in their permanency.

When the census of 1880 was taken, the timber in said States (forests) of economic value was estimated by the writer for the maps which were to show the forest areas. At that time the white pine (*Pinus strobus*) was reckoned as the most important timber and of the most value, and the principal inquiry was directed to that timber.

There was reported May, 1880, estimated upon the methods of logging then in vogue, some one hundred and twenty billion (120,000,000,000) feet of pine timber was standing and growing in said three States. Of this amount quite one-half has been cut.

Estimation was also made of the hemlock, cedar, etc., over the same area; but not so carefully as of the *then* more valuable timber—the pine—but enough to know that, considering the enhanced value, and added information regarding these other forest products, the forest remaining will be of more value than the white pine that has been removed. So that we have even now a vast and valuable forest remaining. The region, especially in Wisconsin and Minnesota, abounds in lakes and streams full of pure, soft water; the soil is mostly of the drift period—a sandy loam, interspersed with sandy and rocky areas, fit only for tree growth, the climate most favorable to the development of a large number of forest trees; altogether the conditions are such as to permit, at small expense and care, keeping the forest, wherever desirable, in good and ever improving condition.

When the lumbermen get through with the merchantable pine timber and move out, this great forest area can rest, recuperate, and grow, and re-establish some of its primeval conditions. There

is a vast amount of hemlock, cedar, linden, maple, oak, and other woods in this forest not found in the forests of the southern States, the rockies, or the Pacific coast, and this hard-wood timber forest of these three timber States must for all time be the base of supplies for the adjoining prairie States. Judging by the amount of white pine that is being cut each year from the three States (some eight or nine billion feet of lumber), and knowing that the white pine is but a small part or percentage of the timber making up the forest proper, we can form some idea of the vast extent and value of the same.

It is a notorious fact that the lumbermen who have had the run of this forest for the past forty years are not poor men. They have paid thousands—yes, millions—of men and women laborers good wages, and the laborers are not poor. A million farmers in their own and adjoining States have had the product from this forest, and they are not poor; even the game that we find is fat, and when we say that the best of the forest is still there it needs no further argument to establish its present and prospective value for its product alone, saying nothing of its protection to water and soil conditions and climatic sanitary value.

Now, what is best to be done for this valuable property to preserve it in ever-producing condition, to prevent its threatened depreciation by fire and improper methods of exploitation, and to secure the benefits that depend upon its preservation?

In the State of Wisconsin—my home—we have the northern half of the State yet in forest, and I will here say the cutting of the white pine does not *destroy* the forest, if properly and carefully done—does not change forest conditions very much; indeed, in some places it is a benefit to the small pines and deciduous growths.

Our State school fund has some half million acres in said forest set aside for schools, universities, etc. Last winter I recommended to our State officers that they withdraw from sale said tracts, and advocated the organization of a State forestry association which, in conjunction with the State officials, should act in its care and preservation, and also to seek to add to its area in various ways. For instance, the General Government has still unsold in Wisconsin a half million or more acres of land within its forest area. I advised to procure from the Government this area and to add it to the State lands. I would also advise lumbermen and land-owners who have forest lands, to turn over to the State such of their lands as they could spare, and thus have the State acquire and hold and care for

forest reserves. I may add a State Forestry Association was so organized in Wisconsin. From these reserves ripe timber could be sold at a profit and still the forest be kept intact. The writer has studied carefully in Europe the methods pursued in forest management at the head of the Elbe, and in Baden, and in other forests, which in the main are perfectly practicable in such a State forest reserve. I would also advise the same plan to be adopted in Michigan, Minnesota, and in fact any State that has forests. Such forest lands in the hands of the State would be free from taxation, but would yield an income from the sale of timber, and they would be, at the same time, a preserve for game and fish and a resort for our prairie neighbors.

I have travelled over the forest reserves of the state of Baden, east of the Rhine valley, and bordering on Switzerland, and in Southern Germany, and I know that the lands of Wisconsin, Michigan, and Minnesota, commonly called "Cut Pine Lands," and considered of but little value now, are quite as good as the "Black Forest" in general if cared for as that of Baden is. In the forests of that State, of about 235,000 acres, not larger than one of our big timber counties "up North," the management employs 92 men as foresters, and there is a good revenue above all expenses of nearly \$3 per acre every year, and yet the timber growth is increasing.

I cannot close without alluding to the greatest bane to which the forests of these States are uselessly and ruthlessly and unnecessarily subjected every year. The losses of valuable forest and other property, and especially the destruction of favorable forest conditions for the future, which is due to the conflagrations during the last two months, show most drastically the need of State care and watchfulness over the same under competent men. The losses this season alone by fires in the forest could, in many instances, have been avoided and an amount saved that would have paid all expense in the care of forests for the next twenty-five years. In this country so few people seem to realize the difficulty and cost of planting timber, and the consequent value of standing timber now to be found in the natural state.

Summing up the foregoing remarks upon the subject, "Forest Conditions of the Northwestern Lumbering States," we recommend that these States and all other States in the Union that own forest land—and most of them do—whether light or heavy, swamp, university, school, or other lands in a wild state, withdraw said lands from sale, except where needed for agricultural purposes,

and make of such lands a forest reserve, added to by donations from lumbermen, of their lands from which they have cut and removed the white pine, having received from this one item alone twenty times the first cost of the land, and who have no use for the remaining soil or timber and would be willing in many cases, for a small consideration, to convey titles to the State. To this might be added either by purchase at a nominal price, as indeed the low price of the "graduated" lands and that of the remaining unsold Government lands in each State will warrant. These lands should be placed all under the care of an intelligent forest commission in each State, who, acting with the State authorities, could estimate and sell the ripe timber, having the same properly cut and receiving for the same full value, instead of selling, as is done now, for a set price, without much regard to relative values, land and timber, which is unbusinesslike and ruinous.

FOREST CONDITIONS AND NEEDS IN THE SOUTHWESTERN TERRITORIES.

By EDWARD F. HOBART, Santa Fé, New Mexico.

[Read at World's Fair Congress, October, 1893.]

The Southwestern Territories, New Mexico and Arizona, contain about ten millions of acres of forest lands. The greater part of this is "pure" forest of yellow pine (*Pinus ponderosa*). Often, however, Douglas firs (*Pseudotsuga taxifolia*) cover the hill-sides that face the north, some of the species attaining a diameter of four or five feet. Occasionally, also, a vigorous growth of aspens (*Populus tremuloides*) occupies a large area, and smaller patches of oak (*Quercus undulata*) are found.

Along the streams are the two species of cottonwood (*Populus monilifera* and *Populus angustifolia*), the box-elder (*Acer negundo*) and other deciduous trees. In the southern part of the Territories the lower growth that accompanies the cottonwood in the valleys is mainly mesquite (*Prosopis juliflora*) and torneo (*Prosopis pubescens*). Also vast areas of rolling lands in different parts of the Territories are covered with a thick growth of pinon (*Pinus edulis*) and cedar (*Juniperus virginiana*).

The climate of New Mexico and Arizona is not favorable to the growth of young trees except in the depths of the undisturbed forest—unless, indeed, they are assisted by irrigation. But not more than one per cent. of the area now covered by forest can be irrigated. The average rainfall outside of the higher mountains does not exceed one inch per month. In the mountains it is double that amount. This small amount of precipitation renders it almost impossible that the forest if once destroyed shall grow again on land trampled by stock, as is the open unirrigated area of these Territories.

Here, then, we have a property immensely valuable—valuable for the excellent lumber that it furnishes for building and other purposes; valuable for the luxuriant pasturage in the forest glades; more than all, valuable for the protection that the mountain forests give to the sources of the water supply. Water for irrigation is the life-blood of the Territories. Upon it their growth and prosperity mainly depend. The precipitation in the mountains comes in great part in the form of snow. But the snow scarcely falls on the mountain peaks before the strong northwest winds that prevail in winter in those elevated regions hurry it off and it accumulates in the wooded valleys, often to the depth of fifty or more feet.

There the giant spruces extend over it their protecting arms, and its melting is thereby so retarded that it feeds the streams the whole summer through. Also, when the rains of summer fall on the mountains they are in part absorbed by the forest cover, and that water is given out slowly to the springs, so that it all becomes available for the use of the irrigator. Where, on the other hand, the hillsides have been denuded of timber the water rushes off quickly, gullying the land and rendering it useless, and floods are produced which cause injury instead of benefit to the farms below.

Here, then, is a matter of most vital importance. The facts are plain. No one who knows the country can doubt them. The Government is directly interested as the owner of the greater part of the forest. The interests of all those living in that vast region also make an appeal, that cannot be justly disregarded, for Government aid, without which nothing can be done. One hundred million of dollars would not compensate for the loss that would result if those forests should be destroyed. And they are being destroyed with great rapidity. Too close cutting, too close pasturing, and forest fires are doing the work. What is needed is some means on the ground of guarding against these foes. The authorities at Wash-

ington, however anxious they may be to help us, are unable to do so effectually under the present system. Even in the case of a devastating fire last summer in the Pecos timber reservation of 300,000 acres, it took two or three weeks' time before I, who was then the proper officer of the Interior Department, could secure authority to extinguish it. I soon thereafter succeeded in putting the fire out, but not until one-fourth of the park had been burnt over. While such a fire does not kill the larger pines, it does destroy the young growth, and so almost ruins the prospects for future years of the section it covers, and it burns up the great spruces, root and branch. During the first rains after this fire the streams rising in the park ran black as ink for days from the forest cover that was destroyed by the fire and which was then washed away, leaving the ground bare and desolate.

Now, if the Government cannot be brought to care for all its forests in a businesslike way, a beginning should at least be made with these timber reservations.

Let us urge that some legislation in regard to them, similar to the Paddock bill, be enacted at once, and then we may hope that the good that will result from such a trial will lead to the extension of the system to all the wooded public domain.

FOREST CONDITIONS ON THE PLAINS AND PRAIRIES OF CANADA.

By WM. SAUNDERS, Director of the experimental farms of Canada,
Ottawa, Ont.

[Read at World's Fair Congress, October, 1893.]

The plains of Canada, which extend from about sixty miles east of Winnipeg, Manitoba, to Morley, in the Northwest Territories, a distance of 940 miles, and from the United States boundary to, in most localities, an undetermined limit in the north, present throughout very varied conditions which influence the growth of trees.

In traversing the country on the great highway to the Pacific, the Canadian Pacific railway, wood growth is seen in every stage of development, from thrifty, well-wooded groves of poplar, box-elder, ash, elm, oak, and birch, to the comparatively stunted forms seen

in the bluffs as the treeless plains are approached. Some portions of the country east of Winnipeg are fairly well wooded, both in the valley lands as well as on the occasional limestone ridges which crop up at several points on the route. On the south side of some of the larger rivers, such as the Red river and the Assiniboine, dense woods, chiefly of poplar, sometimes extend for many miles, while the trees on the northern sides are frequently limited to small clumps or single specimens, and these confined to the immediate banks of the rivers. In the main, however, the great part of the country along the line of the Canadian Pacific railway, after leaving Winnipeg, is almost bare of trees until the first step or rise on the plains is reached, which is about 100 miles west. Then the country becomes more bluffy, and tree growth in many places shuts out the distant view. Here, in addition to poplar, oak, and others, the hardy form of the white spruce (*Abies alba*), which has not been seen along the route for 150 miles or more, appears again and is found growing thriftily on the light soils which prevail along the rapidly rising ground at this point. For 200 miles more the scene is very varying; at one time the whole country is park-like, with clumps of small trees thickly intervening between limited stretches of treeless prairie; then, again, trees become scarcer, and soon the prairie seems boundless and treeless. But beyond Balgonie, 341 miles from Winnipeg, trees along the railway line become a scarce commodity, and, excepting where a few dwarfed and stunted specimens fringe the margin of a watercourse, the traveller will often pass very many miles with no sight of woods or trees as far as the eye can reach, and this condition prevails for more than 500 miles.

The individual who forms his opinion of that country entirely from what he can see from the passing train will often reach most erroneous conclusions. A close examination reveals the fact that these plains, in many places, are not so continuous as they appear to be, but that here and there, separated by greater or lesser distance, are huge ravines or valleys, below the level of the plains, scooped out in bygone times by the forces of nature, of various depths and widths, often from 101 to 300 feet deep, and from half a mile to a mile or more in width, and along the bottom of these there usually runs a small stream of water, often diminished to a series of disconnected pools during the hottest parts of the summer, and swollen into a turbulent stream in the spring-time. In these coulees, protected from the sweep of the winds, and benefited by

the moisture which results from the gradual melting of accumulated snow in the spring and the running water in the bottom, trees thrive to such a degree as to astonish the beholder, and from many such localities the settler can obtain logs in abundance wherewith to construct his first dwelling-place, provide buildings for his stock, and firewood for his use during the winter months. Further, by journeying north of the railway track, across the treeless plains, at distances varying from 25 to 150 miles, trees in abundance are to be found everywhere all across the continent. These rarely form continuous woods for any great distance, but are mostly grouped in clumps and groves, with stretches of open land between them.

The hot winds which, during the summer months, blow northward from the dry and desert regions in the United States, extend into the Territories of Canada, exerting their parching influence to a greater or less degree as they move northward, but constantly weakening until their force becomes exhausted. This influence dies out at varying distances, from 100 to 250 miles from the boundary line, and as the limit is approached changes are seen in the aspect of the landscape: the grass becomes greener, clumps of shrubs and trees appear, at first insignificant and stunted, but shortly they become a prominent feature in the landscape, and within a few more miles the country becomes well wooded and watered. This wooded or partly wooded condition continues for a long distance north. For from 200 to 300 miles it is much the same as when first entered on, but beyond this the Government surveys have not yet extended, and our knowledge of the country is limited to the information obtainable from the Hudson Bay Company's officers located at the different trading posts in the interior and to the published observations of explorers who have, as a rule, followed mainly the course of the rivers in their travels. Mr. Wm. Ogilvie, a surveyor and explorer of the Department of the Interior, a most reliable observer, has, during the past seven years, made preliminary surveys of the greater part of the vast region north, and from his reports a few brief extracts will presently be submitted.

The recently constructed railway from Calgary, Alberta, on the main line of the C. P. R., takes the traveller 200 miles north of that town, or about 325 miles north of the United States boundary. By driving over the Athabasca trail 100 miles beyond this, Athabasca Landing is reached, the starting point of the system of inland navigation established by the Hudson Bay Company. From the Landing to Fort McPherson, at the mouth of the Peel river, a

few miles from the shores of the Arctic Ocean, the furthest point visited by their steamers, is by water travel 1,854 miles, and this established line is used by all travellers and explorers in that country as the basis for their work.

Of the valley of the Athabasca river from Athabasca Landing to Fort McMurray, 282 miles, Mr. Ogilvie says: "In the bottom of the valley there is much spruce and some poplar that would make fair lumber. On the uplands, as far as I saw, there were many places where a similar quality could be obtained. From Fort McMurray to Fort Smith, on Great Slave Lake (287 miles), there is much fine merchantable spruce. The same remark applies to the timber on Great Slave Lake and Mackenzie river (250 to 300 miles further). The timber in the valley of the Liard, one of the streams emptying into the Mackenzie, 1,260 miles by water from Athabasca Landing, deserves special mention, so many of the trees were of large size. All the way from the Mackenzie up to the forks of the east branch and Sicannie Chief river, a distance of nearly 450 miles by the streams, there are large extents of large and good spruce which would make better lumber than any other I have seen anywhere in the country. The balsam poplar, particularly, grows very large; on the east branch many trees were seen of that variety more than three feet in diameter at the ground. At Fort Nelson, 57 miles from the mouth of the Liard, there is a flat, thickly grown with spruce and poplar, where I selected a medium tree of the latter species, cut it down, and found the following dimensions: Diameter of stump, exclusive of bark, 29 inches; diameter, exclusive of bark, at first limb, $17\frac{1}{2}$ inches; length from top of stump to first limb, 90 feet; number of rings of growth, 149." This tree was cut at a point 1,371 miles by river navigation north of Athabasca Landing, while the Landing is about 425 miles north of the United States boundary. From these brief extracts it will be seen that some trees attain goodly proportions very far north in Canada.

The present distribution and growth of trees over the immense area referred to in the coulees and bluff ravines on the prairies and in vast tracts of wooded country in the interior have an important bearing on the future forest conditions of the plains and prairies of Canada. A general sentiment prevails among the settlers on the treeless plains in favor of tree-planting, and a strong desire is expressed on every hand for such trees as will grow and thrive to provide shelter for the home and for the stock, and to relieve the

monotony which attaches to treeless districts. Nearly all such tree-planting, to be successful, must begin with the native sorts, and in the seedling trees and tree seeds obtainable from these hardened denizens of the north we have the most suitable material for this work. On the experimental farm at Indian Head, Northwest Territories, which is located on the edge of that belt of dry country to which reference has been made, many useful experiments have been conducted in tree-planting during the past five years. The land selected for the experimental farm was a treeless tract of prairie. At first it was difficult to obtain sufficient quantities of young trees of native species grown in the country for planting, and large numbers were purchased from tree-growers in Northern Michigan, Illinois, and Nebraska, chiefly of box-elder, green ash, and elm; but in every instance these trees have proved tender and have been injured by the climate here, whereas trees of the same species transplanted from the adjacent valleys or grown from seed ripened there have proved entirely hardy. The idea that young trees having the greatest degree of hardiness can, as a rule, only be had by growing them from seed obtained as far north as possible is not new. Mr. Douglas, of Waukegan, Ill., has for many years had agents employed in collecting the seeds of such conifers as the blue spruce (*Picea pungens*), the Douglas fir (*Pseudotsuga Douglasii*), and the bull pine (*Pinus ponderosa*) as high up in the western mountains as the seed could be found, where the trees would be exposed to a degree of cold unknown in the valleys, and it has been abundantly proven that trees grown from such seed will endure with impunity climatic conditions which would destroy those grown from seed of the same species produced in the warmer valleys. It was not, however, as far as I am aware, generally supposed that this rule, so well known to apply to conifers which hold their foliage the year round, would be found to apply with equal force to deciduous trees. This sensitiveness to injury is not confined in its effects to the severest weather. During the autumn of last year I happened to visit the Indian Head farm on the way home from the Pacific coast and arrived there the day following a severe frost. I cannot now recollect the lowest temperature recorded the previous night, but it would probably be from 12 to 15 degrees Fahrenheit of frost. During the day I inspected two belts of box-elder trees from three to five feet high, one of which had been grown from young trees obtained from Nebraska and the other from seed collected in the neighboring valleys. The trees had lost none of their foliage, and

the difference in the effect of the frost on these two groups was quite striking. The Nebraska trees were all scorched, with the foliage drooping and partly withered, while the trees grown from Northwest seed remained fresh looking and uninjured. Similar difference in relative hardiness has been found to obtain in the elm, green ash, and mossy-cup oak, and I think there is no doubt, from the experience had, not only on the Northwest plains, but also in the other climates of Canada, that it is a law, almost universal in nature, that, to obtain the hardiest trees and shrubs, the seed from which they are grown must be matured at the northern limit of their growth, and that where this is done the natural northern limits of the growth of the species may be gradually extended. To test these points many thousands of young trees have been grown both from Eastern and Western seed, and tested at the experimental farms in Manitoba and the Territories; packages of the young trees have also been distributed to several thousand settlers in different parts of the country, and the general experience has established the correctness of the above conclusions. Acting on the information thus gained, and with a view to encourage tree-planting, there has been distributed during the past three years by the experimental farms more than five tons of tree seeds, all of which have been collected in the bluffs and valleys in Manitoba and the Northwest Territories. These have been distributed, free of cost, by mail to all applicants and have reached fully 10,000 homes. A large quantity has also been grown on the experimental farms. The young seedlings thus obtained have given great satisfaction, and there are now growing on a large proportion of the homesteads on the plains and prairies of Canada nursery plots of young trees from one to three years old, containing hundreds of specimens, which are being transplanted to permanent locations from year to year, as required, to form shelter belts for the dwelling and barns, for the vegetable and small fruit plantations, and to improve the appearance of the farms. In the course of four or five years more, many of the trees will bear seed and will thus furnish the material to enlarge the planting to any extent required, and supply also the wants of new settlers in the neighborhood.

Several hundred specimens of young trees of the white spruce of the East have been sent from the nurseries there to the experimental farms on the Canadian plains, but very few of them have survived, while a large number of young trees of the same species growing on the open prairie, on the first steppe on the plains, have

been transplanted to the experimental farms during the past three years, none of which have shown any indication of tenderness, and nearly all of them are doing well. Many thousand young seedling elms have been dug from under the larger native trees along the river valleys in the northwest, and planted in nursery plots on the western farms; a quantity has also been grown at the Central Experimental Farm in Ottaway from Northwest seed and distributed as seedlings. These have all made satisfactory growth and are proving to be admirably adapted to the climate. Young trees of the Banksian pine have been brought down from Prince Albert, 200 miles north, in the wooded districts, and have proven quite hardy on the plains. An assortment of young trees has also been obtained in the colder districts along the height of land on the north shore of Lake Superior, including the American larch, canoe birch, American mountain ash, and dwarf birch, and these also are doing well. When work was begun on the experimental farm in the Northwest, a large assortment, consisting of many thousand young trees and shrubs of all the hardiest sorts, were sent there for test and were planted, without shelter, on the open plains. A large proportion of these died the first year, and there are now not many survivors left to represent this first consignment. The most notable and valuable exceptions to this fatality are several species of strong growing poplar and willow from Russia, which seem to thrive in almost every situation, however exposed. The European white birch has also proven exceedingly hardy. The same may be said of the *Caragana arborescens*, or Siberian pea tree, which stands the most severe tests equally well with the hardiest natives.

As results of the work in tree-planting during the past five years, we can point to fine groves, shelter belts, and avenues of thrifty and rapidly growing trees on each of the experimental farms; also a large number of hedges of the same material, embracing in all 50,000 to 75,000 trees at each place. Along the western and northern sides of these farms shelter belts are planted 100 feet wide and from a mile to a mile and three-quarters long in each case. The trees in these belts are planted five feet apart each way. Large blocks have also been planted on other parts of the farms, at the same distance apart. In some of these the growth has already become so dense as to furnish favorable forest conditions in the way of shade, leaf covering of the soil, and the conservation of moisture and its accumulation by the collecting of

snow in winter, and the growth in future will probably be much more rapid than in the past. In these closely planted and thrifty belts, where the shelter is ample, other forest and fruit trees, which have proven tender on the exposed prairie, are being tried again, with promising results thus far. A portion of each farm has been enclosed by hedges made of those trees and shrubs which have proven hardiest, thus supplying shelter to long, narrow blocks of land for the growing of small fruits, vegetables, and other products. The intervening hedges are placed from 66 to 112 feet apart, and already, although the hedges are quite young, the advantages arising from shelter are apparent. On the experimental farm at Indian Head a rapid-growing shrubbery, *Artemisia*, has been found very useful in furnishing hedge shelter promptly, owing to its very rapid growth. This shrub was brought to America first by Prof. J. L. Budd, of the Agricultural College at Ames, Iowa, and has been distributed under the name of *Artemisia abrotans* var. *Tobolskiana*, or Russian *Artemisia*. Cuttings of this shrub root very promptly, and, planted in rows in the spring, will usually form a very useful protective hedge by the end of the first or second seasons.

From a careful examination of the results of the planting of all the trees and shrubs tested, there are now at both farms, including the natives, about 100 varieties which have proven hardy and are useful either for shelter, ornament, or forest cover. This work of selection and test will go on indefinitely, and it is expected that within a few years the number of hardy varieties will be doubled. An arboretum has been established at each farm, where specimen trees and shrubs will have space to develop their full proportions, as far as the climate will permit, and by the future study of these much information will be got as to the best uses and combinations which can be made of the individual species.

PROCEEDINGS
OF THE
American Forestry Association



AT THE
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AND AT THE
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CONDITIONS OF FORESTRY IN CALIFORNIA.

By ABBOT KINNEY, Lamanda, Cal.

[Read at World's Fair Congress, October, 1893.]

The condition of forestry in California is as good as a bad thing can be. The Federal Government has at last taken the preliminary steps looking to a national forestry system by reserving from sale important districts of mountain forest lands.

These forest reservations in California are large and well selected. They cover the main sources of water supply for the large irrigation interests of the State, and also those mountains from which torrents now flow and from which new torrents would originate were the forest covering removed. There is, however, as yet, no management of these forest reservations whatever, and no protection, except in the addition to the Yosemite Park.

This exceptional protection has been effective by means of a troop of United States cavalry, by which the Yosemite Park has been patrolled.

The success and efficiency of this protection shows what can be done, and should be extended to the other reservations pending the establishment of a forestry system.

The necessity of some action of this kind is shown by a recent report to me from one of the special land agents. This gentleman states that through one of the entrances to the Sequoia Reservation some 300,000 head of sheep passed in this summer, and that the entire forest, as far as he saw it, was like a dusty road from the effects of this invasion. It is probable that nearly 1,000,000 sheep have been on this reservation this summer.

Forests and sheep are things incompatible, but, in view of the extent of the sheep interests, the using of the California mountain pastures should impress upon us the necessity of a careful and conservative policy in ending this source of injury to our forests.

The State Board of Forestry has been discontinued and its stations turned over to the University of California. This is not a serious loss, for the only effective forest policy is a national one. The State executive system is not sufficiently concentrated to carry on effectively a work of this kind, and, besides this, forest interests

are not separated by State lines, and no harmonious or efficient system could be expected from the independent action of the different States.

We look forward with much hope to the creation of a practical forest system for the government of all the national forest lands.

THE FOREST CONDITIONS IN THE GULF STATES.

By Dr. CHARLES MOHR, Mobile, Ala.

[Read at World's Fair Congress, October, 1893.]

The Gulf region, as considered here, comprises that part of the Atlantic forest division which extends from the Chattahoochee and Apalachicola rivers through the States fronting the Gulf of Mexico, to the treeless plains of Texas. With the exception of the mountainous part, on its northeastern limits, this region can be regarded as a vast plain with a gentle decline from north to south to the seashore, originally almost completely covered with forest; pines and other evergreens predominating in its southern half. Little less than 50 per cent. of its area is still in woodlands, and by far the larger proportion in their original condition.

The most prominent feature of the Gulf region is presented by the great coast pine belt, with its forests of long-leaf pine, which, east of the Mississippi river, extends from the Atlantic slope to the bluffs bordering the alluvial region of this river, with an average width of 125 miles. This eastern coast pine belt covers, roughly estimated, 38,000 square miles. West of the Mississippi river the forest of long-leaf pine reappears upon the deposits of sands and pebbles, of a more recent geological formation, which rise above the lowlands of the Atlantic coast region and the eastern Gulf coast. These western forests of long-leaf pine extend but a short distance below the 31st degree of latitude, and cover an area of between eleven or twelve thousand square miles, nearly equally divided between Louisiana and Texas.

East of the Mississippi river, on the coast plain, the low sandy shores of the Gulf, the headlands and outlying islands above the tide are chiefly covered by the Cuban pine, this tree following the

inlets of the sea and the borders of the swamp lining the water-courses for a distance of almost fifty miles from the seashore. The broad low clay ridges rising above the tide-water swamps were originally heavily timbered with long-leaf pine, associated on their declivities with the loblolly pine. On the extensive flats with their sterile and ill-drained soil, the low pine barrens or so-called "pine meadows," the long-leaf pine is more scattered and the trees of a somewhat stunted growth. In the hummock lands which cover the fertile damp depressions between these ridges the fine live oaks have, to a great extent, disappeared.

The heavier timber growth of the long-leaf pine in the coast plain has been removed. On the better class of pine lands in many localities it has been succeeded by the Cuban pine, yet a second growth of the long-leaf pine is frequently seen to have taken possession of the ground. However promising the second growth appears, it is frequently found more or less injured by the tramping of live-stock and scarcely escapes destruction by fire. These ridge-lands, susceptible of much improvement under cultivation, will, sooner or later, be subjected to the plowshare.

In the flat woods, unsuited for tillage, the renewal of the long-leaf pine finds a great obstacle on account of the seedlings, which happen to start in the fall, being killed by the water which covers these areas for the greater part of the cool season.

The alluvial lands of the rivers and their deltas, subjected to almost perpetual overflow, are covered with dense forests of black gum, water oaks, cottonwood, green ash, and, where the alluvial soil is of greatest depth, tupelo gum and cypress (*Taxodium distichum*) flourish.

In the extensive swamps on the Apalachicola river, among the dense growth of ogeche lime (*Nyssa capitata*), cypress of large dimensions are found which have circumferences of from 12 to over 18 feet above the buttresses of the trunks forming their base, and from 60 to 75 feet in height before spreading out their umbrella-shaped crown. Trees of smaller size are rarely met with and none of second growth have been observed on the older clearings of these swamps. The timber when freshly felled is apt to sink in water; therefore, the trees are deadened by girdling during the summer, and the dead trees are felled the following year, at the time of freshets.

The timber is rafted to Apalachicola, where from 10,000,000 to 12,000,000 are cut annually. In the delta of Mobile river and the

swamps along the lower Tombigbee and Alabama rivers the best of the cypress timber has been culled. From the supplies which reach the shingle mills at Mobile, with an output of 175,000,000 pieces a year (1891), it is evident that the resources of this section are far from being exhausted. The cypress forests existing in other parts of the Gulf region may, in this connection, be spoken of. In the western Gulf region this tree is found most abundant in the swamps and shallow lakes of the Mississippi and Yazoo bottom. In the latter the cypress forms brakes, the gigantic trunks rising above the dark, placid water, from among the strange, cone-like, bald excrescences sent up from their roots to a height from 2 to over 5 feet.

Any attempt to form an estimate of the timber wealth hidden in these swamps and brakes scattered among the 4,000,000 acres of dense forest covering this delta region proves futile. Without an outlet, it has until recently been practically inaccessible. It is only during the past year or two that it is being made available by the railroad lines built through this section. The greater part of Southern Louisiana is covered with cypress swamps; between Lake Ponchartrain and the waters that find their outlet by the Atchafalago river about 1,500,000 acres, more or less, are covered with cypress. Even with the meagre information obtained, it appears that 175,000,000 feet b. m. of cypress lumber and 475,000,000 of shingles are at the present time annually produced in this alluvial region. Under the increasing demand for cypress lumber, which every year is becoming more appreciated, the cypress lands are speedily passing under the control of capital.

In all probability there will, in the future, be neither room nor time allotted for reforestation upon these lands, which are unsurpassed in fertility, if reclaimed and protected from the periodically recurring floods of the Mississippi river.

In the sphagnum swamps lining the pine-barren streams in the lower section of the pine belt, the white cedar or juniper (*Chamaecyparis thyoides*) forms a conspicuous part of the tree growth, the timber of which, having a value equal to that of red cedar, is consequently in great demand; the supplies existing in Alabama and Mississippi are rapidly dwindling away, and the better grades have been already culled.

In the rolling pine lands or pine hills of the eastern Gulf region, rising to an elevation from 150 to 250 feet above the coast plain, the long-leaf pine holds undisputed sway. The wide table-lands,

between the watercourses, broken into low, rounded hills near the waterways, are, without interruption, covered with forests exclusively of long-leaf pine. These forests are open, and almost without any undergrowth; the lightly shaded ground beneath the tall pines is covered with a carpet of various grasses and herbs, principally of the leguminous order and the composite family. According to official returns obtained at the ports of export, not less than 715,000,000 f. b. m. of hewn and sawn square timber and lumber have been shipped annually from the ports in Western Florida, Alabama, and Mississippi and inland by rail during the past few years. Traversed by numerous streams permitting the rafting of the logs to the mill sites, offering in its topographical and soil conditions the best opportunities possible for the construction of tramways to the highways of communication by rail to inland markets, or by water to the sea-ports with their fine harbors and safe roadsteads, this lower section possesses unrivalled advantages, which stamp it at once as one of the principal centres of the lumbering interests of the Southern States.

With the appearance of the calcareous rocks and marls of the older tertiary strata in the upper part of this eastern pine belt the country becomes more broken. With this change in the topographical and soil condition, the forest growth also undergoes a change. Deciduous trees, mostly oaks, hickory, and broad-leaved evergreens, share the ground with the pines. The short-leaf pine is found among the upland oaks, post, black and Spanish oak, and pig and bitternut hickory. The forests of white oak, shellbark and mockernut hickory, ash, beech, magnolias, red cedar, which covered the rich black lands, the so-called prairie lands, in this upper section, have for the greatest part given place to the cotton-field. The area of this division is estimated to extend into Alabama and the adjoining section of Mississippi over 10,000 square miles, and it can be said that fully one-half of the area is covered with long-leaf pine. The timber growth in these pine forests is heavy, and in many localities it has been found to amount to double the quantity found upon a corresponding area in the forests of the lower section of the pine belt. The steep ridges and the greater distance from navigable streams render the transportation of the timber to the mills more costly than in the forests further south, and the consequence of which is that the forests on these hills have been much less encroached upon.

The forests of long-leaf pine on the belt of sands and gravels

which cross Alabama almost centrally from east to west, from 5 to 25 miles in width, do not differ materially in their conditions from those of the lower pine belts. In the basin of the Coosa river the forests of long-leaf pine on the drifted deposits of the valleys furnish timber of excellent quality, and about 25,000,000 feet are shipped annually from Gadsden. In this region the long-leaf pine is found to ascend the mountains to a height of almost 1,000 feet above the sea. The forests on the barren rocky heights of sandstone are very open and the timber of inferior size. The same is to be said of the long-leaf pine on the mountain ranges in the metamorphic region of Alabama, where this tree is found thinly scattered on the highly silicious, rocky soil and considered commercially of no importance. West of the Mississippi river, in the basin of the Red River in Louisiana, the rolling uplands are covered with the forests of the long-leaf pine. Between the broad low hills numerous streams wind their course to the alluvial region, their fertile bottoms timbered with white oak, red oak, black gums, and magnolias. The pine forests are rather open, finely timbered, and, in their general condition, not differing from the forests on the pine hills in lower part of the west pine belt east. Before the opening of the Houston Central & North Arkansas Railway lately, this finely timbered region had remained almost intact. During the past year (1892) the output of the mills along the railroad reached fully 75,000,000 f. b. m. In the area drained by the Calcasieu and the Sabine rivers in their lower course, and in Texas by the Neches river, the forests of long-leaf pine extend, with scarcely any interruption, over a vast, almost perfectly level plain, becoming somewhat undulating only near the watercourses. Their soil of rather impervious silt is water-soaked for the greater part of the year. The timber growth on these "pine flats" is in general found denser than on the rolling land, and the trees are taller. By the owners of these timber lands the merchantable timber standing upon one acre is assumed to average from 6,000 to 7,000 feet, including all sound trees between 11 to 12 inches in diameter. In furnishing the timber supplies for the large mills at Lake Charles, La., Orange and Beaumont, in Texas, and the numerous smaller mills on the Sabine and Texas Railroad, logging is carried on with great activity. In the extensive pine flats steam-equipped tram-roads penetrate the forest for a distance of 12 to 20 miles; east of the Sabine river lateral tracts are laid through the middle of the sections, which are almost completely stripped of their tree growth. Quoting the in-

formation obtained from leading firms engaged in the business, the output of the mills depending for their timber supply on these flat woods appears to have been during the year 1891 fully 700,000,000 feet b. m.

Adding to this output the cut on the pine hills north of the Red River, the amount of lumber produced in the forests of long-leaf pine west of the Mississippi during the same year falls little short of 800,000,000 f. b. m.

The forests of the rolling country, rising above the pine flats in the upper part of Calcasieu parish, according to information obtained, are in about the same condition as those found on the pine hills north of the Red River. On account of their inaccessibility and the distance from the Northern markets, they have remained almost untouched by the lumberman's axe.

Turpentine orcharding, which caused the devastation of millions of acres of long-leaf pine forest, is in the Gulf region confined within its eastern part. It can safely be maintained that the aggregate production of the 361,320 casks (of 50 gallons each) of spirits of turpentine for the period of eleven years, including the year 1880 to the close of 1891, reported as received in the Mobile market, has involved the utter devastation of not less than 2,250,000 acres of timber land. Under the present system of management the bled timber from the abandoned turpentine orchards of former years is speedily disappearing. Conveniently located along the railroad lines and rivers, they are being rapidly cleared. Of late years turpentine orcharding is brought in immediate connection with the lumbering business, and this practice will receive a powerful stimulus, since it has been demonstrated by the U. S. timber tests that the timber is found in no way impaired in its physical qualities by the bleeding. There can be no doubt that in the near future the forests will invariably be worked for their resinous products immediately before the timber is to be felled for the saw-mill.

For the spontaneous renewal of the long-leaf pine in the Gulf region there appears to be no hope under the existing management. Carried on under the high pressure of large investments of capital in large manufacturing plants, with a daily output all the way from 60,000 to 100,000 f. b. m., the supplies transferred from the forests to the mill by costly steam-power and in connection with the modern dry kiln, permitting the sappy stuff of lower grades to be turned into a merchantable article, the forests are almost completely cleared of their tree growth. The scanty remainder, if bled

for turpentine, is laid low by storms or destroyed by fire, and, even in districts where it has not been subjected to this infliction, amounts to little as a factor of future increase. The second growth of the long-leaf pine on the denuded areas, exposed to the periodically returning fires, which, east of the Mississippi, originate in connection with turpentine orcharding, and elsewhere from accident, carelessness, or design, is doomed to destruction. Although the flat woods are less liable to this danger, the renewal of the forest by natural seeding is here rarely found to take place, the cold soil, soaked with water for the greater part of the season, being as unfavorable to the germination of the seed as it is to the growth of the seedling. The flat woods, stripped of their timber during the past twenty-five years, are overgrown with tall broom-sedge grass (*Andropogon virginicus*), and present mostly the aspect of savannas, almost, if not entirely, destitute of trees.

In regard to the remaining supplies of merchantable long-leaf pine timber in the Gulf States, opinions differ widely, and the attempts to estimate for the 10th Census the quantity still existing have evoked severe criticism. The discrepancies find their explanation in the differences of the understanding as to what is considered as merchantable timber.

There must necessarily appear a wide difference between the statements based on a standard which considers solely the higher grades, as was then done, and those made upon the present low standard, which includes every stick with a diameter as low as 10 to 11 inches.

In 1880, only timber squaring 12 inches at the top, free from sap, and without blemish, was considered by lumbermen merchantable; such quality, first cull, formed about one-fifth to one-fourth of the timber growth that would at present be used for milling. This standard of merchantable timber was taken for the basis in the estimates of the merchantable timber standing in 1880, and on a broad average the estimate of 3,000 feet per acre was arrived at, which at that time was considered, by those conversant with such matters, as a fair approximation. If, however, as is the usage at the present time, the total of the timber standing down to that of the low dimensions indicated is taken into consideration in the estimate for the same area, it cannot fail to show widely differing results, namely, from 50 to 70 per cent. of larger yield. With the introduction of the steam-equipped tramway, reducing cost of transportation of the lumber to the mill, and the dry kiln of the present day, low grades

of timber can be profitably converted into merchantable stuff which now find a ready demand in distant markets, while formerly it could not have been disposed of.

In the Gulf region west of the Mississippi, the short-leaf pine is widely distributed, and found in great abundance and perfection of growth. The extensive forests of this species north of the long-leaf pine belt in Louisiana and Texas, extending west to the prairie region of the latter State, are, in the vastness and value of their resources, almost equal to the forests of long-leaf pine adjoining them on the south. In the wide upland region of Northern Louisiana the forests, purely of short-leaf pine, are confined to the ridges of a poorer soil, while on the lands of better soil this pine is associated with upland oaks and hickory.

For want of proper transportation facilities to distant markets the forests in this section have been scarcely touched. In the adjoining part of Texas, forests almost exclusively of short-leaf pine cover areas of many hundreds of square miles in extent. Their timber growth is of fine quality; upland oaks mostly form the undergrowth. In the extensive forests between Texarkana and the town of Marshall the lumbering industry is carried on with the same relentless activity as in the coast pine belt, and the forests are as closely stripped. In the year 1891 about 300,000,000 f. b. m. were shipped by rail to the markets of the Northwest.

By the facilities of dissemination inherent to this species, the spontaneous renewal of the forests is more readily effected than in the case of the long-leaf pine; it is also still further favored by the greater rapidity of its growth. From all appearances the second growth is less liable to destruction by fire on the more retentive soil of the uplands; particularly in the more populated districts groves of second growth of varying age are frequently met with, giving great promise for the future. In the central and the eastern section of Northern Mississippi, and in Alabama, the abandoned fields are soon overgrown with young pines of thrifty growth. It is evident that this pine is destined to play an important part in the forestry of the Gulf region in the future.

The hard-wood forests in the region of mixed growth and in the great agricultural region of Central Alabama, Central and Eastern Mississippi have for the greatest part disappeared on the fertile uplands and arable bottom-lands. At present they are confined to the hills of a poorer soil, to the remoter valleys, and to the unreclaimed alluvial lands. In such situations tracts covered with

their original forest growth are existing, with supplies of valuable timber to meet the wants of a future generation. On the uplands they consist of white oak, post oak, black and Spanish oak, mockernut and butternut, and hickory, interspersed with short-leaf pine, and in the lowlands of swamp white oak, overcup oak, red oak, red gum, ash, shellbark hickory, beech, magnolia, and more sparingly of tulip trees. From the lower valley of the Tombigbee river in Alabama, its headwaters in Mississippi, and from the lower Alabama river and its tributaries considerable quantities of oak, ash, and gum reach Mobile. North of the central belt in Alabama the white oak is the most important feature of the hard-wood forests in the valleys, where the tulip tree is also found frequently associated with this tree. The rugged hills of carboniferous slabs and sandstone are under cover of an inferior growth of upland oaks and hickory. These forests, limited as they appear in the resources of timber of a more valuable kind, are of no little importance to the rapidly developed mining interests of this mineral region of the State, which already cause a heavy draft upon them. In the valleys of the mountain region further north, forests of swamp white oak and tulip trees, with all the other valuable kinds of timber characteristic of the lowlands, are found in quantities to insure large supplies for the near future. The black walnut, at one time not uncommon, is at present only found hidden in the most inaccessible recesses. The 6,000 square miles of the elevated table-land of the Warrior coal basin were a quarter of a century ago an unbroken forest wilderness. The short-leaf pine largely prevails on the thinner soils of the steeper ridges, with post oak, black oak, Spanish oak, mockernut, hickory, and chestnut, the deciduous trees becoming more frequent as the soil conditions improve. At an elevation of about 1,000 feet above sea-level the mountain or tan-bark oak (*Quercus prinus*) becomes one of the most prominent trees on these uplands. White oak of fine proportions is not uncommonly found upon the spots with an accumulation of a deeper, richer soil. In the shallow depressions or swales, destitute of drainage, the loblolly pine arrives at great perfection. In such localities, from 15,000 to 20,000 feet of merchantable timber have been estimated to the acre on smaller areas. The finest forests of hard-wood timber in Alabama are found in the coves which sweep along the base of the mountain ranges bordering the southern side of the valley of the Tennessee river, and in the secluded valleys enclosed by the detached

spurs of the Cumberland mountains north of the river. On the benches of these coves, white oak, Spanish oak, red oak, black oak, with shellbark hickory, are found in abundance and of most perfect growth. The swamp white oak, red oak, willow oak, and ash abound in the broad valley. Considerable quantities of these hard woods are sawn at Decatur and at the smaller mills located on the Memphis and Charleston railroad north of the river. It is claimed that in the remoter valleys in the northeastern part of this river basin the tulip tree is found in quantities equal to any that is found in the most favored districts of the southern Appalachian region. On the outcrops of the mountain limestone, forming the lower flanks of the mountains north and south of the Tennessee river, are found glades of red cedar; on the dry and rocky declivities the timber is knotty, but of late it has become highly prized for telegraph poles, piling, and posts. Timber of finer qualities is found in the damp, narrow valleys among the hard-wood timber growth; red cedar of higher grades, which is eagerly sought for for the manufacture of lead pencils, hollow ware, and cabinet work, is becoming scarce. With their impending exhaustion the cedar glades, formerly frequently damaged by fires, are now being carefully guarded against such accident. What has been said about the forests of deciduous-leaved trees in Central Alabama and in Mississippi applies to the uplands of Northern Louisiana. The upland forests in the more densely populated districts of these States, particularly if in close connection with the farms, have greatly suffered by the heedless devastation of their resources, and by their use for pasture grounds during the entire year, causing their speedy deterioration and eventual destruction. The greatest damage, however, results from the injudicious clearing of the hill-sides for the sake of raising a few crops, which is sooner or later found to be unprofitable, and the land is then abandoned. The subsequent washing away of the soil renders the renewal of the timber growth of any value an impossibility.

The most extensive body of hard-wood forest in its primeval condition on this part of the continent, and unsurpassed in the variety and quality of its timber wealth, is found in the Mississippi and Yazoo bottom, extending over 4,000,000 acres in 1880. With its huge red gums, swamp white oaks, red maples, overcup oak, red and willow oak, sassafras, honey locust, pecan, mockernuts, and cottonwood of gigantic dimensions, its resources appear truly astounding. Black walnut is not uncommonly found on the higher swells of the

ground, and at Indian Bayou in 1880 it was still cut for fencing. These stupendous resources are now being made available by the railroads lately constructed in this delta. On the western bank of the Mississippi river, in East Carroll and Madison parish, in Louisiana, the same conditions prevail with the forests rising above the cypress swamps, the pecan being found more frequently in the western lowlands; large tracts of forest of similar conditions prevail in the valley of the Red river through its extent in Eastern Texas. The hard-wood timber forests west of the eastern timber region of this State, being generally confined to narrow strips skirting the streams, are commercially of little importance. The bottoms of the valleys of the upper Trinity, the lower Brazos, Colorado, and of the Guadeloupe rivers are, however, finely timbered with red oak, pecan, the southern pin oak (*Quercus durandii*) and Texan elm (*Ulmus crassifolia*). The bois d'arc or Osage orange is, in the Gulf region, mostly confined to the upper Trinity valley. The red cedar at one time abundant in the Brazos valley has almost disappeared. The western cedar (*Juniperus occidentalis* var. *conjugens*) is found scattered in numerous clumps over the calcareous highlands around the headwaters of the Guadeloupe river. These cedar glades have been much damaged by the conflagrations to which they have been exposed from time to time.

The two narrow belts of open woods, known as the cross-timbers, which extend from north to south through the bare plains of Western Texas, are covered with black jack, blue jack, or upland willow oak and post oak of inferior size. With the copses of mesquit (*Prosopis juliflora*) which in some localities are scattered over the plain, they are of importance as a source of fuel in the otherwise treeless region of the far Southwest.

Such are the forest conditions of this part of the country, a rational exploitation of which with regard to the future is as little or less to be expected at present as in most other sections of the United States.

FORESTRY IN NEW SOUTH WALES, AUSTRALIA.

By ROBERT HUDSON, Esq., General Superintendent of New South Wales Exhibits, W. C. E.

[Read at World's Fair Congress, Oct., 1893.]

The sea-coast and rivers of New South Wales abound with valuable commercial timbers. The most valuable, red cedar, is principally found on the northern rivers of the Colony, and until very recently the supply appeared so inexhaustible that little care was taken of it by the timber men, who cut all before them, provided it grew near a river where the logs could be rolled from the bank into the stream and made into a raft, which, when completed, contained timber enough to completely fill a vessel capable of navigating these rivers. These rafts had in some cases to float long distances down narrow, tortuous rivers and were towed by a boat or stern-wheel light-draught steamer. The terrible waste resulting from the squarer's axe has at last been stopped, and the stupid fashion of delivering the logs to the market in a squared state no longer exists; the consumer now gets the very best of the tree, which was previously chopped off and burned. It would be difficult to estimate how many millions of feet of the very primest red cedar have been thus ruthlessly destroyed.

Our forest trees have a dull green color, as a rule; some of the brush forests, however, contain trees with deep green and polished leaves; all trees are evergreens, altering little in appearance, if anything, with the seasons.

It is only within the last twenty-two years that the forests of New South Wales have been protected by the Government and timber reserves proclaimed. Indiscriminate felling of trees is prohibited, and only such as are of mature growth and a given girth are allowed to be cut, and then only by persons holding a license. Recently a department entirely devoted to forestry has been organized. In the year 1875 officers were appointed to supervise the reserves, which up to that time had been reserves only so far as they were proclaimed as such. Since that date other reservations have been made, and in 1881 they numbered four hundred and sixty-one, having an area of three and one-half million acres. The wisdom of placing the forest lands of settled States under the control of

the Government has been fully demonstrated by practical experience. Since the adoption of this policy, owing to the prevalence of wanton and indiscriminate denudation of forest lands, and for the effectual control of the unalienated timber lands of the Colony, it has been subdivided into twenty-five districts under the supervision of resident foresters, who are controlled by travelling inspectors. It is the duty of the officers to see that all timber-cutters have their proper license, duly dated, which must be produced for examination and verification when demanded by the inspector, who also carefully examines the tree stumps or fallen timber to see that no tree of unauthorized girth has been cut.

There is a printed schedule of hard-wood trees with the girth measurement affixed to each species, under which these trees must not be felled; the girth is taken at about 5 feet from the ground; for example,—

Blackbutt.....	7 ft. 6 in.
Bush box.....	6 ft. 6 in.
Stringy bark.....	5 ft.

Soft woods, such as cedar, pine, beech (*Gmelina Leichtlinii*), rosewood, etc., have also their safeguard, in the prescribed girth measurement, from the woodman's axe.

At the end of 1891 the Colony had 1,013 forest reserves with an acreage of nearly 6 millions, well studded with most valuable timbers.

Licenses are issued to cut timber on reserves in class A at a fixed fee of \$30.00 per annum (without royalty); on reserves in class B the fee amounts to \$45.00 per annum; on reserves in class C general permits to cut timber for sawmills are issued at \$30.00 per annum, to which is added a royalty differing in accordance with the value of the trees used, and ranges from 40 cents down to 6 cents per 100 superficial feet.

The license fee for cutting cedar and shipping wattle bark from river-bank is \$30.00 per annum, with the reservation that no cedar tree of less than 9 feet girth is allowed to be felled.

Permits are granted also for cutting mining props, for thinning out timber in order to improve the growth of the remaining trees, and for shipping wattle bark or the bark of other trees for tanning purposes.

Infringements of any forest regulations are punishable by fine of \$25.00 for the first offence, \$50.00 for the second, and \$100.00 for the

third, besides the confiscation of all felled and prepared timber, as well as having the cost of the injured timber charged against the offender.

For the year 1891 the revenue from such sources yielded \$92,275, and the expenditure amounted to \$119,375; but, although this item is so much in excess of receipts, a very great deal of useful reproductive and improvement work will result from it; as, for instance, the extensive operations carried out upon the northern reservations for the conservation of the valuable red cedar, the extensive wattle plantations, which are carefully thinned out, and the treatment of the valuable red-gum saplings on the Murray river reserves, the returns from which in a few years will fully repay the outlay.

The work carried on by the forestry department included the planting of 16,450 trees, distributing to schools 75,000 trees, thinning out of 2,000,000 red gum trees on the Murray river reserve, planting 7,000 red cedar trees on the cedar reserve, 128,000 wattles thinned out; the total number of trees operated upon exceeded two and a quarter millions. The forest area of New South Wales is estimated at 21 million acres.

During the year 1891 over 100,000 trees were supplied to public schools and corporate bodies to celebrate the Arbor Days lately introduced and so prolific of good results.

The State nursery consists of about 65 acres, carrying a stock usually of one and a quarter millions of trees, comprising over 250 varieties. All this work is being vigorously pushed under the department of forestry.

The forestry department has recently paid some attention to planting trees along the railway lines within the railway reserves, a system introduced by the executive commissioner to the W. C. E., when he held the office of minister for mines, and this scheme is likely to be greatly enlarged. On one section of the railway reserve at Cootamundra, there is a plantation of American Catalpa (*Speciosa*) consisting of 2,700 trees, doing remarkably well; also, a quantity of black walnut. In the cedar reserves there have been over 30,000 trees planted, taken from nurseries where they are raised, in immense numbers, from seeds.

This, briefly, is the law of forestry and the rules for forest conservation, and only a feeling of regret can be expressed that these laws and licenses were not in force many years earlier, when millions of feet of most valuable timber might have been saved and the forest of to-day would have been worth millions of dollars more than it is at

present; but by judicious planting and thinning, together with jealous care of the trees still coming to maturity, New South Wales will stand out as a bright example for other colonies to follow.

FOREST CONDITIONS AND FORESTRY PROBLEMS OF VENEZUELA.

By Dr. A. ERNST, Commissioner at World's Fair for Venezuela.

[Read at World's Fair Congress, Oct., 1893.]

Following too closely a remark made by Humboldt, most writers on the physical geography of Venezuela divide the country into three distinct zones, viz., the agricultural, pastoral, and forest. The first region comprises the mountains and valleys between the coast of the Caribbean Sea and the interior range of a rather complicated orographic system which as a prolongation of the eastern chain of the Colombian Andes runs through the whole Republic towards its northeast corner opposite the island of Trinidad, being 70 miles wide. The pastoral zone extends from the southern limit of the former to the Orinoco and Apure rivers, and consists of extended plains, interspersed here and there with raised table-lands, called *mesas*, and watered by numerous streams that in the rainy season inundate the bordering plains for many miles. The forest zone, as understood by these writers, stretches from the Orinoco southward to the frontier of Brazil, and is comparatively an undiscovered country, traversed by great rivers and covered with limitless forests, abounding with all kind of tropical birds, beasts, and reptiles.

This division, however, is but partially exact. It is true that in the first region are found almost all the agricultural establishments of the country, and that cattle-raising is the principal industry of the inhabitants of the second or pastoral region. But the most important and valuable forest-tracts are by no means situated south of the Orinoco, and are to be found within the borders of the so-called agricultural zone. There the forest begins in many places on the very shore of the sea with an almost impenetrable belt of mangrove-vegetation, composed of species of *Rhizophora*, *Avicennia*, *Laguncularia*, and *Conocarpus*, which is followed towards the land by extensive thickets of the sea-side grape (*Coccolobis Uvifera*), *Bontia daphnoides*, *Capparis amygdalina*, etc. The

slopes of the mountains are covered with forest wherever the soil is favorable and the rainfall sufficient for the development of an arboreous vegetation, and only on the highest parts, from 10,000 feet upwards, the trees disappear and are replaced by shrubs of a more or less dwarfish size.

There are, however, many instances where the mountain slopes even at lower elevations are covered only by a dense sward of grasses, amongst which grow some smaller plants of other families, especially Leguminosæ and Malvaceæ. It is extremely difficult to account for the origin of these savanna-like tracts in the midst of the forest, as the conditions of soil and climate are the same. But the grasses once well established, their roots form such a compact stratum that the seeds blown down from the neighboring trees find, of course, no place to germinate, and thus the forest cannot advance.

The luxuriance of vegetation in tropical forests is so well known that I deem it superfluous to dwell on it. The extraordinary thickness of the layer of vegetable mould which covers the soil is remarkable. The leaves are, in a great many of our forest trees, compound in a high degree—a circumstance which allows the light of the sun to penetrate to the soil beneath, and to contribute thus to the development of an abundant undergrowth of shrubs and herbaceous plants.

There is, however, in the forest a remarkable lack of flowers, which sometimes disappoints the botanical collector very much, whereas about the edges of the forest, on watercourses or open savannas, there is an abundance of flowering plants of all descriptions.

Another peculiarity of all tropical forests is the great variety of species even on a limited spot. There is nothing similar to the large and uniform oak or pine forests of the northern temperate zone; the species do not grow gregariously, but are intermixed in the most confusing manner. This is quite a serious difficulty when a certain species of timber is needed in a large quantity, as, for instance, for railway-ties, which, for this reason, are generally so expensive that the companies prefer to bring steel ties from Europe, although those made of *lignum-vitæ* (*Guaiacum arboreum*) are considered to be of superior quality.

Although I have been studying the flora of Venezuela for many years, I cannot say that all the forest trees of the country are botanically known to me. Every one who has seen a tropical forest

will easily understand how very difficult it is to collect in many cases sufficient material of the large arboreous species for scientific classification. In my report on the National Exposition at Caracas, in 1883, I have given a descriptive list of 652 species of trees, which were represented on that occasion by 2,070 samples. Not all of them yield valuable timber, but I am sure not to overstep the limits of truth in saying that at least one-half of that number deserve to be classed as such. There is a smaller collection of our most notable woods exhibited in the Venezuela pavilion in Jackson Park, which was partly prepared under my personal supervision, and an alphabetical list of these samples, accompanied by short descriptive remarks, inserted in the catalogue which I prepared of our exhibit.

The most important species belong to the following families: Lauraceæ, Meliaceæ, Zygophyllaceæ, Rutaceæ, Euphorbiaceæ, Leguminosæ, Myrtaceæ, Rhizophoraceæ, Rubiaceæ, Sapotaceæ, Styracaceæ, Bignoniaceæ, Apocynaceæ, Samydaceæ, and Palmæ.

Man has done hitherto nothing in Venezuela for the conservation and improvement of forests; they are in every respect such as nature has made them. Some grow on lands belonging to the nation; many are the property of private individuals; but in neither case have the science and practice of forestry been applied to them. The cutting of timber is done wherever and whenever the circumstances allow it, mostly for the benefit of carpenters and cabinet-makers in the country, and comparatively small quantities are shipped to foreign countries, especially from the ports of Maracaibo and Puerto Cabello. The trade is far from being developed, as the supply is uncertain and the expenses generally too great. The wood-cutters, of course, prefer those parts of the forest which are in the neighborhood of rivers, in order to float the logs down to the seaboard, whence they are shipped to either of the ports mentioned. Splendid timber, however, grows on almost inaccessible places, and the cost of transporting it would be much greater than its commercial value. In some cases the logs are sawn in the forest into boards and square pieces; the former generally half an inch (*foeros*) or one inch thick, and the latter (called *cuartones*) measuring about four inches each way. The work is mostly done by hand. Saw-mills are as yet rather uncommon, though they might be established almost everywhere without difficulty, water-power being generally within easy reach.

The amount of lumber brought to market is, however, not quite

sufficient for the requirements of the artisans. A considerable quantity of pitch-pine is imported from the United States, principally for flooring. A large sawmill in Caracas receives likewise much square timber (pine) from this country and cuts it into boards. It is very singular that among all our many species of woods not one has been found suitable for the making of matches, so that the two large manufactories of this article at Caracas import pine wood even from Norway.

In some parts of the country the forests are recklessly destroyed by charcoal-burners. This happens, of course, especially in the neighborhood of the larger towns and cities, where charcoal has a ready sale at comparatively high prices. The public authorities have been obliged to interfere on several occasions; for instance, in Caracas, in order to prevent a decrease in the quantity of water that the rivers which have their feeders in the mountain forests carry down to meet the constantly increasing requirements of the capital. This is the only case, as far as I remember, that any provision has been made by authority of the law in reference to a forestry problem. The time, however, I hope is not far distant when the Government of Venezuela will pay a more than transitory attention to the many questions connected with our forests, and adopt a system of judicious supervision which, whilst putting a stop to all reckless destruction of forests where the water supply of any of our towns might be endangered, or irrigation in agricultural districts interfered with, will regulate at the same time the cutting of useful timber, even on lands belonging to private individuals or corporations.

THE GREAT COAST FOREST OF THE PACIFIC SLOPE: ITS RESERVATION A NATIONAL DUTY.

BY E. W. HAMMOND, Wimer, Jackson County, Oregon, Vice-President
American Forestry Association.

[Read at World's Fair Congress, October, 1893.]

The object of the present paper is the advocacy of the reservation, by the General Government, of the great coastal forest of the Pacific slope, this being a matter of prime importance in any comprehensive plan for an intelligent administration of the public forests.

This great coast forest is one of the four principal divisions into which Prof. Sargent, in "Trees of North America," divides the woods of the Pacific region.

It extends southerly along the coast in a narrow strip from the sixtieth to the fiftieth parallel, where it widens, embracing the shores of Puget Sound, and, following the abundant rainfall of the region, extends eastward over the high mountain ranges north and south of the boundary line, covering Northern Washington, Idaho, and portions of Western Montana. South of the fiftieth degree of latitude the coast forest occupies the region between the ocean and the eastern slopes of the Cascade range. In California the summit of the Sierra Nevada marks the eastern limit of the coast forest, which gradually disappears south of the thirty-fifth parallel, although still carried by the high ridges of the coast range nearly to the southern boundary of the United States. Owing to the influence of favorable climatic conditions, this region is one of the great forest centres of the continent, where, with unusual density of growth, is produced timber of the grandest proportions, not surpassed within the temperate zones.

When the fact is realized that, at the present time, as shown by the Chief of the Forestry Division in an address before the Real Estate Congress at Nashville, Tenn., in 1892, we are cutting from our forests each year an amount of timber equal to twice the annual reproduction; and when it is known that we are cutting timber at a rate which will exhaust the entire forest capital of the country within a period of from 60 to 70 years at the most, allowing for increased consumption due to increased settlement and development of the country, it is evident that the establishing of great forest reserves at the present time is only a matter of common prudence and foresight.

From a comparison of the estimates of timber consumption and reproduction it is evident that the time has arrived when it is essential to take thought concerning the future of the timber supplies. More than this, there is cause for alarm at the prospective injuries threatening the country from changed conditions, disturbing the waters and impoverishing the soils—results of the present irrational treatment of the great forest property of the nation.

It now appears, from a study of past developments, that a not inconsiderable portion of the arid regions of the far west and southwest will yield to the progress of agriculture, and that the next great movement in the settlement of the American continent

will be the more complete occupation of the Pacific slope and the utilization of those portions of the vast arid interior which may be secured to agriculture by the employment, through irrigation, of the waters now largely running to waste.

After the occupation of this great region by a population such as now generally anticipated, the forests of this area will not long sustain the attacks made upon them unless the General Government comes quickly to their rescue and devises some plan for their rational management. There are some large and valuable bodies of timber upon the western slopes of the northern Rocky Mountains and on the high plateaus and mountain ranges of Arizona and New Mexico, which, with any rational management, will afford a sufficient supply of fuel and lumber for the local needs for a long time. The remaining woodland of this region consists mainly of scattered and stunted growth, of little value except for fuel, fencing, and for mine-props.

Aside from the great timbered areas and this scattered growth, the whole western arid region is practically treeless. The only exceptions are the forests upon the Blue Mountains of eastern Oregon, and upon the sparsely-timbered ridges of central Nevada. But the forest growth upon these has only a local value, and in Nevada is apparently doomed to early extinction. The once magnificent forests of the eastern portion of the United States are being rapidly depleted of their commercial timbers to meet the demands for lumber of a great and growing country, partly through the habits of our people in the extravagant use of the wood, and even more largely by the annually recurring forest fires—the results of wilfulness, carelessness, ignorance, or greed.

It is evident that the future population of the treeless interior region must look for the necessary supplies of timber to the mountain ranges upon the extreme western border of the continent. The magnificent tracts of pine and fir which clothe the sides of the Sierra Nevada and the great redwood forests of the California coast may yet be preserved in part. But the vast primeval forests of the northwest coast, and especially the great coniferous areas of Oregon and of Washington, which lie within the limits of the great coast forest, as above described, must be the chief reliance in this respect. Here the climatic conditions are such as to render the maintenance of forest conditions a matter of comparative ease.

The purely local considerations immediately concerning the communities in which the proposed forest reserves are situated, it is not

the purpose of the present paper to discuss. It may be said, however, that it is the positive duty of the Government to insure the perpetuation of sanitary conditions dependent upon the maintenance of an abundance of pure and wholesome water in springs and streams. It also may justly be considered as within the duty of the Government to foster and encourage all legitimate industries of the country in so far as this may be done by a wise and conservative management of the natural resources upon which these several industries depend. This is especially the case when these resources are of such a character that the Government alone has the controlling power.

The opinion largely prevails among those not properly informed that the purpose of the forest reserves is to withhold from present use large bodies of valuable timber, thus retarding the development of the region. This is not the case. The purpose is mainly that these forest properties shall be so managed that their productive capacity shall not be seriously impaired. Besides being retained as regulators of our water supplies and perpetuators of sanitary conditions, they should be made to produce indefinitely, under a wise management, a succession of valuable crops of timber.

These lands, covered by these forests, being unsuited for general agriculture, should thus be kept in useful occupation. Their value to the nation as perpetual producers of an important natural resource should be recognized by their being dedicated by the nation to this useful purpose. As permanent timber reserves, all danger from changed conditions of water supply, in so far as dependent on forest conditions, would, of course, be averted.

Of the many reasons for placing the great forests of the northwest coast under Government control as timber reserves, a most important one is that, notwithstanding the abundant annual precipitation of this region, the rains are distributed so unequally as to leave these forests for a good portion of the year exposed to the risks of fire. During the summer and fall, the whole country becomes little better than a vast tinder-box, and in the absence of any care extensive forest fires prevail every year.

It appears to be a favorite theory in certain quarters that these annual fires are mainly the result of the carelessness of campers. But, from a long residence on this coast, and an intimate acquaintance with the people here, the writer is convinced that in many cases these fires are set purposely by ignorant and irresponsible persons, unconscious of the injury or indifferent to results. As

a result of the recent wide discussion of forestry matters by the press of the country, and the information sent out by the forestry division at Washington, a more general appreciation of the value and importance of the forest has begun to prevail. But nothing short of the presence of a paid fire patrol, intelligent, energetic, and alert, would be in the least effective in restraining the reckless and ignorant who are to be found in every community.

The forests, if left to nature, would doubtless, under the influence of the abundant rainfall of the region, recuperate themselves in time, although every stick of merchantable should be cut from them—with this important difference: under our present irrational methods of lumbering, ordinarily all the finest trees are among those felled, and only worthless specimens are left to seed the ground. Under such circumstances the usefulness of the forest as a timber-producer in time becomes seriously impaired, which it is not the part of wisdom for the Government to permit. The nation must have due regard for the interests of the future community as well as for those of the present. Hence, it cannot wisely permit wanton destruction. With the rational methods of lumbering under Governmental control of the forests, as in the proposed timber reserves, a succession of equally good, or even better, crops could be secured, since the composition of the forest as to desirable kinds would be in a measure under control.

As to the location of the boundary lines of the proposed timber reserves, these should be designated only after a full investigation and study of the region by a body of competent scientific men. In determining the extent of the proposed forest reserves the preservation of the streams should be of first consideration. This is a matter of such great importance that further inroads upon these forests should not be permitted until this matter has been fully considered; and this can only be intelligently done after a complete survey and examination. In my opinion, this matter of the preservation of the streams is of such paramount importance that nothing should be allowed to stand in the way. Next to this the local needs as to timber supplies—both as to the present and the future—should be carefully considered. Lastly should be taken into the account the demands which commerce is likely to make in the future upon these forests.

This preliminary investigation and study of the forests and of the needs of the country should be most thorough. In the meantime, whatever power the act of March 3, 1891, has conferred upon

the President in the way of establishing timber reserves it is to be hoped will be employed by him in the selection of proper sites for such reservations wherever, as in the case of the great forestal region under consideration, these can be shown to be of sufficient national importance.

FOREST RESERVES OF THE WESTERN MOUNTAIN REGION.

By EDGAR T. ENSIGN, Colorado Springs, Col.

[Read at World's Fair Congress, October, 1893.]

In the Congressional act of 1876 providing for a forestry investigation, and, subsequently, the formation of a forestry division in the Department of Agriculture, the Federal Government took the first decisive steps toward conserving the forest wealth of the nation and averting the evils consequent upon the indiscriminate destruction of forest growth. In the admirable work since performed by the forestry division, there is found ample justification for its creation and continued existence.

In March, 1891, another decided advance was made in forestry legislation. Congress then incorporated in the revised land law the following provision:

“SECTION 24. That the President of the United States may from time to time set apart and reserve, in any State or Territory having public land bearing forests, in any part of the public lands wholly or in part covered with timber or undergrowth, whether of commercial value or not, as public reservations, and the President shall, by public proclamation, declare the establishment of such reservations and the limits thereof.”

This law is the result of long and persistent advocacy of the reservation and classification of all public timber lands. During the brief period of its existence, no less than sixteen large forest reserves have been established, most of them in response to local requirement. Except in one instance, they are situated in the States and Territories of the western mountain region; usually upon the high ranges, at the sources of streams. In extent they vary greatly, the largest one embracing some 6,400 square miles, nearly twice the area of Delaware and Rhode Island. The aggregate extent of the

reservations is about 22,000 square miles, or something more than the total area of Massachusetts and Maryland. It should be noted, however, that the areas given are the estimated areas lying within the exterior boundaries of the reservations. The lands actually reserved are only the vacant, unappropriated public lands within the established boundaries.

The distinction between national parks—created by earlier legislation—and forest reservations should not be overlooked. The former—as, for example, the Yellowstone National Park and the Yosemite—were established by special acts of Congress; individual titles, if any, within their borders were extinguished, and in their government the principle of excluding private interests prevails. Forest reserves, as we have seen, are established under a general act; no private holdings therein, whether perfected or not, are disturbed; and it is the declared policy of the Government to provide, under proper safeguards, for the necessary use of timber upon the reservations, and the development of their natural resources.

It should be noted, however, that somewhat anomalous conditions now exist within the territory of the reserves. In the case of my own State, Colorado, the formation of forest reservations has been effected at the instance of the resident population, but with the understanding that, with respect to the territory reserved, permits would be granted for the necessary use of timber, prospecting, mining, development of coal, stone, marble, and other deposits, construction of irrigation works, etc. Practically, however, under the terms of the proclamation, all rights of user or entry upon the lands are denied; and the Government authorities state that these prohibitions will continue until Congress provides a system of administration for the reserves.

Existing public forest reserves may be divided into two general classes:

1. Those created principally for the conservation of forest growth, in view of its effect upon the volume and flow of streams.
2. Those established mainly for the preservation of natural scenery, or for other reasons, without special regard to the conservation of water.

To the first class belong the reserves in California, Wyoming, Colorado, and New Mexico, and many others that have been proposed. To the second class may be assigned the reserves in Washington, Oregon, and the Grand Cañon reserve in Arizona. And with the latter should be named the Yellowstone, Yosemite, General

Grant, and Sequoia national parks, were these under consideration. The several forest reservations are herewith given, noting briefly not only those that have been established, but certain other proposed or desirable ones.

WASHINGTON.—In this State is the *Pacific Forest Reserve*, situated on the Cascade range, overlooking the southern waters of Puget Sound. It is quadrangular in form, and has an estimated area of 1,512 square miles. Mount Tacoma, with its snow-covered summit and wonderful glacial system, is the central feature. The tract also includes Paradise Valley, the Nesqually Palisades, the Cascades of Lost River, and numerous hot springs. West of the summit the Cascade range is covered with the heaviest continuous belt of forest growth in the United States, this extending over the slopes of the Coast range also. Additional forest reserves will doubtless be established in this State.

OREGON.—In June, 1892, was issued the proclamation establishing the *Bull Run Timber Land Reserve*, in the northwestern part of the State. This reservation is also on the Cascade range; it is irregular in form, and has an estimated area of 222 square miles. It includes Mount Hood, and is bordered on the north by the Columbia river. Later a far greater reservation was made, including a large part of the heavy forests of the Northern Pacific region. These follow the Cascade and Coast ranges, and extend through Western Oregon, from the Columbia river southward, some 200 miles. This belt is 50 to 100 miles wide, and large portions of it lie at an altitude of 7,500 feet and upwards above the sea. Upon the summits of the high ranges snow and ice remain continuously; and here, also, many glaciers are formed. Upon the continued existence of these forests, from which flow powerful streams, depend the irrigation privileges of a country the approximate area of which is 20,000 square miles.

CALIFORNIA.—The *Sierra Forest Reserve*, the most notable, extends for a distance of nearly 180 miles. It adjoins the Yosemite National Park on the south, and the Sequoia and General Grant National Parks on the west. The mountain crests in this reserve vary in height from 2,000 to 12,000 feet. The *San Bernardino Forest Reserve*, still further southward, has an estimated area of 1,152 square miles, the greater portion consisting of coniferous forests.

Immediately west of the last-named reserve lies the *San Gabriel Timber Land Reserve*, similar in character, and having an estimated area of 868 square miles. Southward, upon the Santa Ana Moun-

tains, is the *Trabuco Cañon Forest Reserve*, having an estimated area of 78 square miles.

All of the California reserves cover the sources of important streams, the waters of which serve to irrigate some of the richest portions of the State.

The heavy forests of California are confined to the Coast range, the eastern and western slopes of the Sierra Nevada, and the group of mountains joining these ranges in the northern part of the State. Although the forest reserves already established include about 8,500 square miles, other reservations are likely to be formed in the heavily timbered districts of the northern Sierra Nevada and Coast ranges. In fact, for the highest development of the region all of its native forests should be carefully conserved.

ARIZONA.—In Northwestern Arizona has been formed the *Grand Cañon Forest Reserve*. It is quadrangular in shape, and has an estimated area of 2,893 square miles. The Colorado river flows through it, entering at the northeast. It embraces the most striking features of the Grand and Marble Cañons, also a considerable portion of the Kaibab Plateau, and on its southern portion the Cocino Forest. The region has already become famous for its gigantic and impressive scenery. It will take high rank among our great natural parks. The heavy forests of pine and fir which cover the sources of streams, important to the irrigation interests of the Territory, should be protected.

UTAH.—The Wasatch and the Uintah mountains, as well as portions of the great Colorado Plateau, bear at high elevations coniferous forests of considerable extent. The western flanks of the Wasatch range have been nearly stripped of good timber for the supply of the valley settlements, and there is need of early and adequate provision for the conservation of the forests and streams.

IDAHO.—Upon the western slopes of the mountain ranges separating Idaho from Montana and Wyoming are found the principal forests of the first-named State. No forest reserves have, as yet, been established in the State. One has been proposed, adjoining the Yellowstone National Park on the west, and including some timbered lands in Montana. Besides this is the proposed *Meadow Creek Forest Reserve*, in Northwestern Idaho. An important timber belt is one covering the high divide between the Salmon river on the north and the Weiser, Payette, Boise, and Wood rivers on the south. To denude this region of its timber would be exceedingly disastrous to the agricultural interests of Southern Idaho. Doubtless a num-

ber of forest reserves, in addition to those named above, should be established in the State.

MONTANA.—In this State the most dense and continuous bodies of timber are found on the western flanks of the main range, and on the Cabinet, Cœur d'Alene and Bitter Root mountains, which are contiguous to it. These forests, which extend to Eastern and Northern Idaho, are among the most extensive and valuable of any in the Rocky Mountain region. A number of proposed forest reservations in this State are in various stages of progress; none, as yet, being established.

WYOMING.—It is quite generally known that the Yellowstone National Park is mostly situated in Wyoming. It covers an area of nearly 4,000 square miles, at the northwest corner of the State. One of the new forest reserves, called the *Yellowstone Park Timber Land Reserve*, immediately adjoins the tract on the east and south, being substantially an addition to the park. Its estimated area is 1,936 square miles. It possesses remarkable natural features, bearing a general resemblance to those of the park itself. In addition to the Yellowstone reservation, two or three others have been suggested, and are in course of investigation.

COLORADO.—Colorado was among the first of the Western mountain States to agitate the question of forest reform. She has already secured a number of important reservations, and other proposed reserves are in the preliminary stages.

The *White River Timber Land Reserve*, proclaimed in October, 1891, was the first of the forest reservations established under the new law. It is situated in the northwestern part of the State, on an elevated, wooded plateau, and has an estimated area of 1,872 square miles. Southwestward of this, and quite near, is the *Battlement Mesa Forest Reserve*, which embraces within its boundaries two large, timbered plateaus, known respectively as the Grand and Battlement Mesas. The estimated area of this reserve is 1,341 square miles.

The *South Platte Forest Reserve*, in Central Colorado, has an area of about 1,068 square miles. It occupies the high ranges immediately surrounding South Park, and nourishes many of the tributaries of the South Platte river. Lost Park, a favorite haunt for wild game, and affording refuge for a small band of buffalo, forms a portion of this reserve. The city of Denver, and adjacent farming country, are largely dependent upon the streams of this

region for their water supplies. Immediately east of this is the *Plum Creek Forest Reserve*, a triangular tract of wooded, mountain country, proclaimed as a reservation in June, 1892, and having an estimated area of 280 square miles.

The *Pike's Peak Forest Reserve* lies adjacent to and south of the one named above. It embraces the greater portion of the Pike's Peak range, including the mountain of that name. Its area is about 288 square miles. The streams flowing from it afford water supplies for Colorado Springs, Manitou Springs, Colorado City, and other smaller towns, and also furnish irrigating waters for the adjacent agricultural valleys.

The Colorado State Forestry Association has memorialized the President, asking for the reservation of all public timber lands in the State, situated upon the high ranges. Many prominent citizens and officials also joined in the request. So far as known, no official action has been taken thereon.

NEW MEXICO.—The *Pecos River Forest Reserve* is in Northern-Central New Mexico, covering a portion of the rugged mountains known locally as the Taos range, and lying in the vicinity of and northeastward of Santa Fé. Its estimated area is 486 square miles. It includes the sources of the Pecos and Canadian rivers. The proposed *White Oaks Forest Reserve*, in the south-central part of the Territory, is under investigation. Another proposed reservation covers the Sacramento mountains, a range situated near the southern boundary of the Territory. The desirability of forming a large reservation upon the Mogollon and Tularosa ranges, near the western border, has also been suggested.

The limits of this paper do not permit me to dwell upon the peculiar characteristics and attractions of the several forest reserves. While some of them embrace most remarkable natural features, they all, without exception, include woodland and mountain scenery of great interest. They abound in running streams, waterfalls, and deep, clear lakes. Their rugged heights afford striking contrast to adjacent sheltered valleys and natural parks. Within their deeper recesses are the habitat of native wild game and fish, which, as well as the forests, need the protecting care of the Government.

Now that so many extensive forest reserves have been established, and others likely to be formed soon, the question of immediate importance is, What provision shall be made for their due administration?

The public lands, including these reservations, are under the con-

trol of the Secretary of the Interior. That officer, doubtless, has sufficient authority to formulate regulations for the government of the forest reserves. Unfortunately, the means at his command for the enforcement of such provisions are inadequate, and Congress alone can afford relief. Various measures in this behalf have been proposed. Many advocate the use of the mounted troops of the regular army for the protection of these reserves. This plan has already worked well—at least in the one or two instances where it has been tried. The small cavalry command at the Yellowstone Park and reservation renders excellent service in the prevention of forest fires and of depredations.

LIST OF NATIONAL FOREST RESERVATIONS AND NATIONAL PARKS OF THE UNITED STATES.

No.		Established.	Estimated area.*
			<i>Acres.</i>
1	Yellowstone National Park timberland reserve (Wyoming)...	Sept. 10, 1891	1,239,040
2	White River Plateau timberland reserve (Colorado).....	Oct. 16, 1891	1,198,080
3	Pecos River forest reserve (New Mexico).....	Jan. 11, 1892	311,040
4	Sierra forest reserve (California).....	Feb. 14, 1893	4,096,000
5	Pacific forest reserve (Washington).....	Feb. 20, 1893	967,680
6	Pike's Peak timberland reserve (Colorado).....	Mar. 18, 1892	184,320
7	Bull Run timberland reserve (Oregon).....	June 17, 1892	142,080
8	Plum Creek timberland reserve (Colorado).....	June 23, 1892	179,200
9	South Platte forest reserve (Colorado).....	Dec. 9, 1892	683,520
10	San Gabriel timberland reserve (California).....	Dec. 29, 1892	558,520
11	Battlement Mesa forest reserve (Colorado).....	Dec. 24, 1892	858,240
12	Afognak Forest and Fish Culture reserve (Alaska).....	Dec. 24, 1892	Unknown.
13	Grand Canyon forest reserve (Arizona).....	Feb. 20, 1893	1,851,520
14	Trabuco Canyon forest reserve (California).....	Feb. 25, 1893	49,920
15	San Bernardino forest reserve (California).....	Feb. 25, 1893	787,280
16	Ashland forest reserve (Oregon).....	Sept. 28, 1893	18,560
17	Cascade Range forest reserve (Oregon).....	Sept. 28, 1893	4,492,800
	Total acreage of forest reserves.....		17,564,800
	NATIONAL PARKS.		
18	Yellowstone National Park.....	Mar. 1, 1872	2,142,720
19	Yosemite National Park.....	Oct. 1, 1890	967,680
20	Sequoia National Park.....	Oct. 1, 1890	161,280
21	General Grant National Park.....	Oct. 1, 1890	2,560

* It must be understood that the lands actually reserved are only the public lands that were vacant and unappropriated at the date the reservations took effect—something less than the areas above given—they being the estimated aggregate areas within the boundaries of the reservations. Title to portions of the lands within the reserves has passed out of the United States, and still other tracts are occupied by *bona fide* settlers, who located before the creation of the reservations, and who are not interfered with as long as they comply with the law, and who can complete titles upon showing their compliance with the law.

FOREST ADMINISTRATION—FEDERAL OR STATE ?

By **GEORGE H. PARSONS**, Colorado Springs, Col., Vice-President
American Forestry Association.

[Read at World's Fair Congress, October, 1893.]

"Trees are the best friends of man, and forests of nations." The single tree may be pruned and cultivated and brought to its full perfection of beauty and usefulness by the individual; but the great forests which cover the surface of the earth, the growth of centuries and far-reaching in their influences, can be effectually protected and preserved only by the community itself, which alone is able to combine the interests of all. But the question may well be asked, What is the nation? The foundation of the United States of America is shown by its motto, and where there is one nation made from many nations, the question arises, Which nation shall control the forests—the one or the many, the central government or the State governments?

In the early days of the existence of this Government the public lands were held by the States alone, and all action relating to the forests was necessarily at that time undertaken by the States within whose borders the forests were. But as new territory was added a large amount of land came into the possession of the Federal Government, which is estimated at nearly three million square miles. A great portion of this has been sold, but there still remains an immense area, including about 50,000,000 acres of forest. This is a large tract to watch and guard properly, and the question for us now is, How shall it be done? Shall we follow the tendency of our country toward centralization? Can the Federal Government do this work, or must it be divided among the States? This is one of the problems of the age, and the sooner it is seriously considered the better, for upon its prompt solution depends a large and most important area of forests, with the welfare of a great country.

The best teacher is experience, and the results of past efforts are the only sure guides for future enterprises. We will, therefore, in connection with the question before us, briefly examine the work for forestry from the earliest settlement of this country, and, by

comparing the enactments of State legislatures with the achievements of the Federal Government, draw our conclusions for the solution of this problem.

In the settlement of the country the forest was an impediment to the progress of civilization. It covered the land, and must be subdued by axe and fire before food could be had for the people. In its dark recesses lurked a thousand dangers, so that antipathy was aroused against it, which descended from father to son for many generations. Still there were some wise men in that far-away time who knew the beneficial influences of the forest, and lifted their voices in protest against its destruction. Probably the earliest colonial action relating to forests was in Massachusetts, where certain regulations concerning damages from forest fires were placed on the records in the year 1631. Towns, as well as the general court, took action for the protection of the forests. Before the end of the seventeenth century the cutting of timber, except under certain conditions, was forbidden in Connecticut, New York, or New Netherlands as it was then called, and Pennsylvania. In the latter community was the wise provision of the governor, William Penn, "that in clearing the ground care be taken to leave one acre of trees for every five acres cleared." In the early part of the next century Rhode Island, New Hampshire, New Jersey, and Delaware adopted laws to prevent fires and the general cutting of trees. The province of New Hampshire had, in 1708, a surveyor-general of forests appointed by royal authority.

After the formal organization of the Government of the United States we find that the laws of colonial times to prevent forest fires were continued everywhere, and now each State and Territory has some law providing more or less severe punishment to any person setting fire to woodland or prairie. There is a great similarity in all legislation of this nature, but as it is very difficult to find the offender, or to convict him afterwards, laws of this class are operative, if at all, by their threat rather than by their execution. With few exceptions, this law has become a dead letter. The forests are consumed now as frequently and extensively as ever. The census of 1880 shows that 10,000,000 acres of forests, valued at \$25,000,000, were destroyed by fire in the United States in that one year. This may be considered as below the average, for an estimate by the Forestry Division last year showed that more than 12,000,000 acres of woodland were burned over during 1891. This loss does not take into consideration the very great damage done to property

other than the forest. The only States said to be comparatively free from forest fires are Maine and Massachusetts, and especially New York, whose forest commissioner reports that they are now a thing of the past.

Another law, adopted very generally, is one to encourage the planting and growing of timber and shade trees. This is found on the statutes of twenty-two States and Territories, or about half the total number. It generally provides for a bounty to be paid for a certain number of growing trees, or for a rebate in the tax on land so planted. These may be planted in clumps, or along the roadsides, and land so cultivated shall not be assessed for improvements. Penalties are also laid upon any one convicted of injuring any tree. This law has been adopted more generally in the prairie States, where trees were lacking to so great an extent that the settlers became tree-planters almost from necessity. It has been the means of covering with trees thousands of acres, and has driven the prairies many miles westward. Kansas is credited with the largest area planted with forest trees, nearly 120,000 acres, and Nebraska comes next with 78,000 acres. This law has done much good, but, after all, tree-planting along roadsides and in small, isolated clumps is not forestry, and legislation of this kind, though indirectly aiding the cause in an educational way, does not preserve nor create forests.

In the same direction of education is the appointment of Arbor Day, which has now become a legal holiday in thirty States and Territories. It is celebrated in the public schools, and is thus made a most important factor in creating an interest in trees and a knowledge of vegetable life among people at their most impressionable age.

A legislative action of late years, which was thought would result in great good to the forests, was the appointment of regular forest commissioners or commissions. The duties of these officers are principally to prevent and extinguish forest fires, bringing the guilty ones to punishment, to report regularly to the governor all things pertaining to the forests in the State, and in every way to preserve the forests and represent their interests. These were first created in 1885 in four States—California, Colorado, New York, and Ohio. Kansas and Michigan followed in 1887, Dakota in 1890, Maine in 1891, and Pennsylvania in 1893. Massachusetts has directed its State board of agriculture to act as a board of forestry. The commissioners began work actively and enthusiastically, but at the present time it is a question whether they are

able to do much good. One of the most efficient at first, that of California, which established several experimental stations and acquired considerable property, has failed to accomplish what was expected. It became a political machine, under the control of "practical politicians," who used it as a means of partisan reward, and gave no attention to forestry. The outcome was the abolition of the commission, the turning of its property over to the University of California, and the transferring back to the United States of the Yosemite Park, because the State was incompetent to manage it. The forest commissioner of Colorado no longer exists, the legislature having failed to appropriate money for his expenses. The New York forest commission is the only one which has really accomplished anything. This is owing to the large State ownership of forest lands and the large annual appropriation. It has set aside as a forest reserve an area of nearly a million acres in the Adirondack region and Catskill mountains, and a bill is now before the legislature for the issuing of bonds for \$750,000 for the purchase of more land for this purpose. But in this large tract no real forest management exists, although the protection is quite complete.

As long ago as 1888, Prof. C. S. Sargent wrote in the *Garden and Forest*, "The field of usefulness of these commissions is limited, and the work must be advisory and educational. They must become, if they are to justify their existence, the teachers of the people in all that relates to the forest." The Ohio forestry bureau, in its report for 1888, frankly accepts the position of Prof. Sargent, and plainly states that "the great object of its promoters has been to furnish the people of this great State the much-needed information in matters pertaining to forestry." Education may be now accepted as the only work which can be accomplished by the State forest commissioners or commissions.

What is the result of the legislative action of the States in relation to the forests? Fires still burn as before, and devour annually many times as much lumber as is cut by the saw-mills. The encouragement of tree-planting by bounties and tax-exemption has in no way increased the area of forest land, and the forest commissions have become mere boards of education. As far as any practical benefit is concerned all the laws now on the State statute-books relating to forests might as well never have been enacted.

And now let us turn to the Federal action in relation to forests. The first movement of the General Government to preserve the

timber was for the building of a navy. In 1799 Congress appropriated \$200,000 for "the purchase of growing or other timber, or of lands on which timber is growing, suitable for the navy, and for its preservation for future use." Under this act two small islands on the coast of Georgia, containing together about 2,000 acres, were purchased. Nothing more was done until 1817, when an act was passed directing the reservation of such public lands, producing live oak or red cedar, as might be selected by the President. Under this act about 19,000 acres were reserved in Louisiana, and ten years later 11,000 acres were acquired by purchase. By additional acts of 1820 and 1827 the President was authorized to take proper measures to preserve the live-oak timber growing on the lands of the United States, and to reserve such lands in sufficient quantities as to render them valuable for naval purposes. Under these various acts nearly 250,000 acres were reserved in Alabama, Florida, Louisiana, and Mississippi. In 1822 an act was passed authorizing the President to employ the land and naval forces to prevent the destruction of timber in Florida, and to take such other measures as might be advisable for the preservation of the timber there. By an act of 1831 provision was made for the punishment of persons cutting or destroying any trees growing on the land of the United States. Under this act, up to the present time, all the protection they have had has been secured for the public forests. Until 1855 this protection was carried on under the Treasury Department. But in that year it was transferred to the Land Department, where it has been somewhat effective for the prevention of trespassers upon the public lands.

After the action above named, which was more on account of the navy than of any recognition of the beneficial influences of the forest, nothing more was done by Congress for its forests until 1876, although many bills were introduced more or less connected with timber lands. In this year the timber-culture act was passed, by which a person planting and maintaining 40 acres of timber trees on Government land was entitled to 160 acres at the expiration of ten years. This was changed twice, and finally amended in 1878 so as to reduce to 10 the number of acres planted. In this form it remained until 1891, when it was repealed for the reason that, owing to its crude provisions and the lack of proper supervision, it had been abused, and had given rise to much fraud. It is estimated that about two million of acres were planted with groves under this law. They will prove of benefit to the districts in which they lie,

but it is a question whether this benefit will compensate for the fraudulent acquisition of a large amount of land from the Government.

So far, we have seen that the action of the Federal Government had done little good for forests. But the time was at hand when the voices of those crying in the wilderness would be heard. It has been truly said that the interest in the preservation and conservative use of our natural forest areas was first systematically aroused when Mr. G. B. Emerson and Dr. F. B. Hough, in 1873, engaged the attention of the American Association for the Advancement of Science in the subject, and a memorial from that association to Congress led to the enactment of a law, in our centennial year of 1876, directing the Commissioner of Agriculture to appoint a competent person to make inquiries and investigations into the destruction of our forests, and into the measures necessary for the preservation of our timber. Dr. Hough was at once appointed, and made two reports. This action led to the formation, in 1882, of a Forestry Division of the Department of Agriculture, with Dr. Hough as its first chief, followed by Mr. N. H. Egleston. In 1886 Congress made this Division an integral part of the Department, when the present most able and efficient exponent of forestry, Mr. B. E. Fernow, took charge of it. With the organization of this Division the interest of the Federal Government in the preservation and growth of forests may be said to have begun. Its policy has been to establish a regular system for gathering and disseminating information regarding the forests of the United States. Special agents were appointed to investigate the needs of different portions of the country, and a large amount of material has been published. Considering the brief period this Division has been at work, great progress has been made. It may be said, without hesitation, that nowhere else, within an equal compass, is there to be found in the English language such an amount of information in regard to the subject of forestry. Necessarily its work at first had to be chiefly historical, statistical, and educational. The Forestry Division has carried on the theoretical branch with great success, and prepared the way for the practical, which is now at hand.

If the interests of the Federal Government in forests was first shown by the organization of the Forestry Division, its first practical movement for their care and preservation may be considered to have been the act of Congress of March 3, 1891, by which the President was authorized to set apart and reserve any portion of the

public lands, wholly or in part covered with timber or undergrowth, as public reservations. This action is a most important step towards a proper forest policy on the part of the Government, and marks a new era for this country. The law was followed up actively by the administration, and fourteen reservations have been proclaimed by the President, aggregating 13,000,000 acres,* and lying in Arizona, California, Colorado, New Mexico, Oregon, Washington, and Wyoming. A number of locations have been temporarily withdrawn from the market and are now subject to examination prior to their final permanent reservation. Other reservations have also been made by special enactment and not under the law of 1891. The first of these was the Yellowstone National Park, created in 1872. Then followed the Yosemite, the Sequoia, and the General Grant National Parks in California, the Hot Springs Reservation in Arkansas, and the Chickamauga National Park in Tennessee. These comprise about 3,500,000 acres. There is every expectation that this work, so well begun, will continue until all the forest lands of the United States are permanently reserved from sale. With such a large area some provision becomes necessary for their protection and administration. And thus we come back to the question we started with, a solution of which we are earnestly seeking.

Our examination of history has shown that all the State forest legislation since colonial times has been ineffectual, except, perhaps, in New York, where peculiar conditions exist. It has shown that little of the national legislation has been available for good, and a century of ignorance passed before the first effective enactment by Congress was secured. We have learned from the experience of the past that for some reason the State government is not as yet capable of grasping the needs of this problem, and providing for it an adequate solution. It may be that the local requirements, the individual interests, and the grasping nature of monopolies, with the tendency to drift into the control of unscrupulous politicians, form a barrier against the preservation of the forest by the State. On the contrary, the legislative and executive branches of the National Government are able to take a broader view of the requirements of the case, are not so trammelled by local interests, and, having a more thorough organization than the State, may command and obtain more efficient aid. Certainly no one will deny that from the results of over a hundred years the Federal Government has shown itself

* Now 16 reservations, with over 17 million acres.

better able to work out this problem and apply its solution than the governments of the States.

There are other reasons for the administration of the forests by the National Government which will occur to many, but I will now present but two. One of the most important of the many beneficial influences of the forest is the protection it affords to the springs and brooks, thus maintaining a regular and steady supply for the large rivers which flow through the length and breadth of our land. These rivers cross several States, and it will be very difficult for those in one State to legislate to preserve in their full efficiency the fountain-heads of a river which lie in another State. Truly, any work involving the welfare of two or more States must of necessity be carried on by the General Government, for no one State can be depended on to legislate for the benefit of another.

But the most important argument in my mind for the national control of the forest is that in the military department they have an organization ready to undertake, with little extra expense, the immediate and most effective management of not only the reserves and parks already made, but of all the forest area. Something must be done at once. Over ten millions of acres of forest are destroyed by fire each year. It is criminal to stand idle while this great loss is going on. We cannot afford to wait for the slow educational methods by which alone we are able to secure the necessary action of legislature and Congress for a thorough forest administration. By a brief resolution Congress may authorize the Secretary of the Interior to call upon the military department to aid him in the preservation of the forest. It is not an impracticable plan, and two years ago was approved by Thos. H. Carter, Commissioner of the General Land Office, who has had long experience in the prosecution of timber thieves. It also receives the approbation of many officers of the army.

The Chief of the Forestry Division lays down the following principles for forest management: "(1) proper organization of an efficient service; (2) protection against theft, fire, or other damage of property; (3) regulation of the occupancy and the use of the reservations by citizens; (4) a system for cutting the crop and marketing it according to the needs of the population; (5) reproduction of the crops and maintenance of proper forest conditions." Surely these principles may be applied effectively by the army, and there is abundant precedent for this action. The Yellowstone Park has been for a long time under the admirable care of a troop of

cavalry, and so has the Yosemite Park. In British India, when the forest department was first created, the officers were taken from the army, and this custom has prevailed in certain countries of Europe. Under this plan the forest would be regularly patrolled by a mounted body of active, disciplined men, accustomed to hard riding and quick action in all emergencies, and fully under the control of officers whose rule in life is full performance of duty, no matter what the consequences.

Nor would the benefit be to the forest alone. The army would thus have an object for its existence in times of peace, and would render some return for the great expense of its maintenance. The long marches through the wild mountain regions of the forests would accustom the men to the hardships of campaigning, and a school would be provided which would prepare them for war far better than any drill of camp or field. As shown in our last great war, where military operations were almost invariably carried on in wooded countries, an intimate knowledge of forest operations and forest life is of great advantage to all troops. The best soldiers have always been those born and bred in mountain forests. Lieutenant Wood, in command of the Yosemite guard, says "that the work makes better soldiers and better men of his command, and the men and animals are infinitely better prepared for any real military work than they could be by any garrison duty." He speaks also of the improved moral tone of the men. Mr. Carter, the former Land Commissioner, states "that the army, both officers and men, have been not only prompt, but enthusiastic in aiding to preserve the parks, and all that makes them beautiful and instructive." Colonel Merriam, in charge of the military post at Denver, Colorado, strongly favors the use of the army to guard the Government forests. But he does not wish to see the army degenerate into a mere police force. It is obvious that, although at first this would be their chief duty, it would not be the final result. Very soon would arise the work of developing the many resources of the forest, and if it remain under the charge of the army, there would soon be a chair of forestry at West Point, and officers regularly drilled in the various operations of true forest administration.

From the study given this problem, it has been found that the only solution is for the Federal Government to continue the creation of forest reserves, so well begun, and turn them over to the care of the army. In this way the terrible destruction of the forest will be at once checked, and gradually a complete and thorough

system of forestry will be developed fully adapted by experience to the peculiar customs and needs of this country. Let us hope that the beginning of a new century will see the Government of the United States fully committed to a sound forestry policy, and actively engaged in a thorough and effective administration of our magnificent forests.

TIMBER AND WOOD CONSUMPTION IN THE COMSTOCK MINES.

By WILLIAM ALVORD, San Francisco, California, former president of the American Forestry Association.

The successful operation of the mines of the Comstock lode requires vast quantities of timber, lumber, and wood, for the walls and ore bodies are notable for want of firmness and tenacity. The friable nature of the ore, which renders its mining comparatively easy without blasting, except to fracture large masses, has a counter disadvantage in requiring an expensive system of timbering in order to make extraction safe. Some of the mines are not only exceedingly deep (over three thousand feet), but also of great width. On the 1,550 level of the Consolidated Virginia mine a vein three hundred and thirty feet wide has been worked out. In this and various other mines of the lode veins ranging from sixty-five to two hundred feet in width and consisting of high-grade ore have been completely extracted. The ore of the vein in the Consolidated Virginia, above referred to, furnished an average yield of one hundred and twenty-six dollars of silver and gold to the ton. Such ore is too valuable to be utilized for chamber walls or as principal supports, as is done in most of the mines of the world.

The enormous pressure resulting from the weight of the overlying formation is sustained by an elaborate net-work of costly timbering, which has been admired for its completeness and strength by many skilful mining engineers. Without vast quantities of massive timbers to keep the walls in place, with correspondingly great quantities of wood to generate power for pumping, hoisting, and reduction of ores, the great bulk of the precious metals which the Comstock mines have poured forth would never have been obtainable. To rifle the mineral kingdom of its glittering treasures, man had

first to levy upon the resources of the vegetable kingdom. Without the aid of the forests the wealth of the Comstock would have been as far beyond human reach as the fabulous secrets of the alchemists. These constant drafts of the Comstock mines upon the mountain forests have led to the christening of the lode as "The tomb of the Sierras."

When the mines of the Comstock lode were discovered the surrounding mountains were sparsely covered with a growth of scrubby pines (*Pinus Edulus*), commonly known as pifion or nut-pine, interspersed with a stunted variety of juniper (*Juniperis Virginiana*), generally called cedar. These woods were the most valuable of all for fuel, being hard, resinous, and fine-grained, but were worthless for timbers and lumber, being too small. They supplied the wants of the mines during the prospecting and surface-mining eras and as long as fuel only was wanted. As soon as any considerable depth was reached, the supply was exhausted and the forests of the eastern slope of the Sierra Nevadas, where accessible, were encroached upon. The forest-line of these mountains has receded westward before the woodman's axe until now it is west of the eastern crest of the Sierra range and almost on a line paralleling the western shore of Lake Tahoe, fairly within the limits of the State of California.

Timbers, lumber, and wood are now principally supplied to the Comstock mines from the southern portion of the Lake Tahoe basin, on the California side of the State line, by the Carson and Tahoe Lumber and Flume Company, a corporation entirely independent of the mines. The wood and logs are first transported about twelve miles over the company's railroad to the lake shore at Bijou, the railroad extending, over piles seventeen hundred feet out into the lake, to a depth of water where the steamers and barges can moor alongside of the track. The wood is unloaded from the cars on barges having a carrying capacity of from seventy-five to one hundred and forty cords each. The logs are dumped from the cars into the lake and enclosed in boom timbers forming immense rafts.

The company has two powerful steamers engaged in towing these barges and log rafts to Glenbrook, on the eastern shore of the lake. At this point the logs are sawed into timbers and lumber which, with the wood, are reloaded on cars and transported up a long incline to the summit, over another railroad, about ten miles long, belonging to the company. At the summit these are unloaded and conveyed through a flume for about twelve miles, to the wood and lum-

ber yards at Carson City, Nevada, and from there taken by the Virginia and Truckee R.R. twenty miles to the mines, making a total distance of sixty-five miles from the forest, over two rugged mountain chains. From the forest to the mines the timber, lumber, and wood are necessarily handled thirteen times.

In the operation of its system the Carson and Tahoe Lumber and Fluming Company owns and uses thirty miles of railroad track and switches, two locomotives, forty cars, two steamboats, six barges, and twenty-five miles of flume. This flume is in form of a V, and is provided with all of the improvements which the experience of twenty years in flume transportation have suggested. It has thirty-two to thirty-four-inch sides, a top width of from forty-five to forty-eight inches, and has a diamond in the bottom of from five to seven inches. It was constructed in 1870, has been in use ever since, and has a reliable supply of water from springs and creeks in the high Sierras. It has a carrying capacity of six hundred cords of wood a day, and will transport the heaviest mining timbers as well as lumber and cord-wood.

About fifteen thousand cords of wood are annually supplied from the forests surrounding the headwaters of the Carson river in Alpine county, California, these being floated down the river in drives during the early summer stages of water. About eight thousand cords a year are consumed in the mills along the Carson river, and the remainder is shipped by rail to the Comstock mines.

At present, 120,000 acres of the Sierra Nevada's choicest forests around Lake Tahoe and 75,000 acres around the headwaters of the Carson river have been denuded to operate the mines. When it is considered that this area equals an expanse of land three hundred and five miles long by one mile wide, it will be apprehended that there is good reason for calling the Comstock "The tomb of the Sierras."

Not more than 10,000 acres of timber land and 35,000 acres of woodland are now available to supply the mines. Upon the exhaustion of these it will be necessary to develop the timber regions north of the Truckee river in order to obtain an adequate supply of timbers and wood. This will remove the base of supplies more than one hundred miles from the mines, and will require a heavy expenditure to construct lines of transportation.

None of the Comstock mining companies have ever owned or controlled their timber supplies, but have relied on independent companies or individuals for the same.

From January 1, 1880, to January 1, 1891, in all, 249,756,000 feet of timbers and lumber were shipped to and used in and about the Comstock mines. During the same period 100,776,440 cubic feet of wood were consumed, and to the latter amount should be added 11,264,000 cubic feet consumed by the Carson River mills, auxiliary to the mines, making a total of 875,316 cords. These figures are taken principally from the books of the Virginia and Truckee R.R. Co., and may be relied upon. For the decade commencing January 1, 1870, and ending January 1, 1880, which includes the period of development and working of the bonanzas in the Crown Point, Belcher, Consolidated Virginia, and California mines, the timber, lumber, and wood used cannot be ascertained with exactitude, but a conservative estimate by men most familiar with the facts and with sufficient data upon which to base a nearly correct estimate fixes the figures at 425,000,000 feet of timber and lumber and 268,800,000 cubic feet of wood, to which should be added 10,240,000 cubic feet used in and about the Carson River mills.

In 1870 the timber and lumber sold for \$35 per thousand feet at the mines, and wood at \$13 per cord, but the prices have gradually fallen since that time, until now timber and lumber are sold at the mines for \$22 per thousand feet, and wood for \$9 per cord. A conservative and probably underestimate of the average price paid at the mines for timber and lumber since 1870 is \$23 per thousand feet, and for wood \$10 per cord.

Summarizing the above statistics, the Comstock mines since 1870 have used 674,756,000 feet of timbers and lumber, and have paid therefor, at \$23 per thousand feet, \$15,519,388.

During the same time the mines and mills have used 391,070,488 cubic feet of wood, costing, at \$10 per cord, the sum of \$30,553,160; making a grand total cost of \$46,072,548. The pumping machinery of the mines was partially stopped in 1882 and entirely shut down in 1884, which accounts for the much smaller quantity of wood used in the last eleven years than was required for the ten years previous thereto.

The consumption of forest products by the mines for the period embraced between the discovery of the Comstock lode and 1870 can hardly be approximated, as there are no data for that time obtainable, but an estimate that the entire cost of timbers, lumber, and wood used in and about the Comstock mines, from the date of their discovery until the present time, is \$55,000,000, could hardly exceed the true amount.

With the exception of the shafts and bulkheads, the prevailing system of timbering in the Comstock mines is that devised by Mr. Philip Deidesheimer in 1860 and commonly known as the "Deidesheimer system." It consists of timbers so framed that when a post is set up there is a place on its top for the ends of four caps, and when these are placed in position a mortise is formed into which the end of the next post fits. The same connections are made with each of the four posts, forming a hollow cube, and there is always a place for the caps of the sets to be fitted on any side.

These sets form cribs of timber six feet square, strengthened by timbers connecting opposite corners in the manner of diagonals of squares. These cribs, when completed, make convenient places in which to stow away waste rock, and make the whole almost as firm as the original material. These sets are as compact as the cells of a honeycomb, to which they bear a striking resemblance except in figure, and by repetition may be extended in all directions to any distance that may be required. This system of timbering exemplifies the truth of the old adage that "Necessity is the mother of invention," for without it the Comstock miners could do nothing, but with it, the mines can be safely worked to any depth, width, or length.

The seemingly endless labyrinths of timbers in the Comstock mines when ignited and beyond control make a subterranean fire which burns and smolders for years. Many lives have been lost in the mines by reason of these fires, but none have been recorded as having been lost because of any inherent defect in the timbers or system of timbering.

A large proportion of the timber and lumber used in these mines has been in the constructing of shafts and bulkheads. Many of these shafts are from two thousand to more than three thousand feet deep, and are completely encased in timbers. In the Consolidated Virginia mine there is one bulkhead three hundred feet long, two hundred feet high, and eighty feet wide, containing 57,650,000 feet of timbers. Another bulkhead in the same mine is one hundred and fifty feet long, one hundred feet high, and fifty feet wide, and contains 9,000,000 feet of timbers. There are other bulkheads of smaller dimensions, but containing in the aggregate vast amounts of heavy timbers.

The sizes of the timbers used in these mines vary from the huge pieces sixteen inches square and twenty-four feet long to the smaller pieces eight inches square, used in cribbing.

The species used consist of yellow pine (*Pinus ponderosa*), fir,

(*Picea magnifica*), and cedar (*Thuja gigantea*), of which the latter is found in such small quantities as to be hardly worth considering. Fully two-thirds used is yellow pine, about one-third fir, and less than one per cent. is cedar.

In a comparison of these woods, in point of durability, red fir would rank at one hundred per cent., yellow pine at ninety per cent., and white fir at sixty-five per cent. In a comparison in point of strength, red fir would rank at one hundred per cent., yellow pine at ninety per cent., and white fir at about ninety per cent. In the generation of heat, they would rank in the order of yellow pine, red fir, and white fir. Yellow pine is a favorite timber with mine carpenters on account of its exactitude in joining. Cedar is inferior to no known timber, not even excepting red wood, for its lasting qualities under ground. Yellow pine has been taken from the lower levels of these mines so compacted by the enormous pressure it has withstood as to have a density and weight exceeding *lignum vitæ*, and has been made into handsome paper weights and other ornaments.

None of the timbers in the Comstock mines have yet badly decayed and their life there cannot be accurately determined. The heat and the vapors of the mines, surcharged with mineral matter, appear to have a decidedly preservative effect upon the timbers.

Nearly or quite all of the timber cut for these mines is felled during the winter and spring months; it is flumed during the summer and autumn months, but the timber and lumber are in the water only during their passage through the flume—not more than an hour and fifteen minutes. Upon being discharged at the mouth of the flume in the yards, the timber is at once piled up in such a way as to prevent warping and cracking and so that the air can circulate freely between each piece. The wood remains until shipped as it is discharged by the flume. As it is built up almost to a level with the flume, the latter is extended so that the wood is piled up by the water in long pyramidal masses about thirty feet wide at the bottom, ten feet wide at the top, and about twenty feet high; being thoroughly wet when discharged by the flume and drenched as piled, it remains more or less wet for several months and sometimes partially sours. For this reason, flume wood will not generate quite as much heat as will wood which has never been in the water. The effect of the water on timbers and lumber, when handled as herein described, is hardly appreciable.

The area upon which the forest has been cut off to supply the

mines is now growing up, principally in pine, but the reproductive growth is so slow that it will require more than a century for the trees to attain a size sufficient to furnish the timbers required by the mines. The new growth is very thick, but as it becomes large the economy of nature, "the survival of the fittest," will kill out the weaklings and leave the stronger young trees at a proper distance apart. On some of the lower slopes of the mountains where the new growth is over twenty years old there are few trees ten inches in diameter, and the average diameter will not exceed six inches. In the Tahoe Basin, which has been cut over principally within the last ten years, the reproductive growth is about five feet high and will average about four inches in diameter. It is especially noticeable that in the Sierra Nevadas fir predominates on the north slopes where the snow remains the longest and the sun shines the least. On the other slopes pine largely predominates. This indicates that the Sierra fir thrives in a colder climate than is congenial to pine. A further fact is noticeable, that the reproductive growth contains a much larger percentage of pine and a less percentage of fir than the original growth contained. This is satisfactorily accounted for by reason of the sun reaching the ground after the primeval forest is cut off. As the new growth becomes larger and the ground is shaded a larger number of young pines than firs die, but a careful observation leads to the conclusion that when the trees become large enough for use the percentage of pine will exceed and that of the fir be less than in the primeval forest.

The present condition of the mines seems to indicate that the timber available will be adequate to their demands, but if extensive ore bodies should be discovered in the lode, or additional lodes within fifty miles of the Comstock, an enormous expenditure must be incurred to supply necessary forest products.

THE EFFECTIVE METHOD OF ADVANCING FORESTRY INTERESTS.

By HERBERT WELSH, Philadelphia, Pennsylvania.

[Read at World's Fair Congress, October, 1893.]

The swiftness of the development of our country, owing to the vastness of its resources and to the enormous influx of foreigners, the stimulus that our free institutions give to every department of our life, result in confronting us with a multitude of problems—moral, social, economic, political—which, for their solution, tax the

thought and resources of the individual citizen to a greater degree than is the case in any other country. The privileges of our unusual advantages as a people entail a correspondingly weighty obligation. If the vast resources of the republic are to be preserved unimpaired for the future it will not be by laudations of the past, or by present devotion to the acquisition of individual riches, but by continuous patriotic gifts of thought, time, and effort to the best development by each citizen. The fundamental principle of advance under popular government is the responsibility of the individual for the good of the whole. Such considerations as these are necessary in the solution of our forestry question.

A small group of experts for years have been warning us of the danger of the situation—of the economic loss should the waste of our forest resources be unchecked. If wise legislation does not step in to protect the forests which supply the lumber market, conserve the streams and arable soils, an impoverishment of one of the greatest sources of wealth of the nation will ensue. It is a situation calling for prompt action by the Federal Government and by the individual States, but such action cannot be hoped for until the laborious preliminary work of popular agitation has been accomplished.

It must not be forgotten that the best legislation does not originate with legislators, but is born of popular demands. But how can the popular mind be aroused to demand a reform of this character? It is only through the systematic reiteration of the facts in the ears of the legislator by the tongues of his constituents. But this can only be accomplished through permanent organization, for it takes numberless blows to set swinging the pendulum of a popular demand for reform. The experiences of the Pennsylvania Forestry Association will illustrate this thought, and may be of service to forestry workers elsewhere.

The work of this organization began in the heads and hearts of a very few intelligent and public-spirited women, who were helped and stimulated to persevere by the encouraging advice of a devoted forestry worker, Mr. J. B. Harrison. Then came into the field an added number of men and women of the class most necessary to such movements—men and women who, while not pretending to exact scientific knowledge of the subject, have a fair understanding of it, are profoundly impressed with its importance, and are willing to lend a helping hand. Then came naturally the organization of a forestry association, to be followed by much faithful individual and associated work. This included a very considerable use of the

press, the publication of "Forest Leaves," the printing of many leaflets, the holding of public meetings in various parts of the State, especially in the neighborhood of Philadelphia, and ineffectual attempts to secure the passage of a bill through the State legislature creating a forestry commission.

Good preliminary work was done by the association, but much better work was needed. It was necessary to arouse the people representing the various interests in the State to the real necessity for action, before the legislature could be moved to pass the bill. What was needed was a general secretary of full experience and the best attainments—a man armed with both the knowledge and skill that would enable him to represent the cause with convincing force to the people of the State. This want was finally relieved by the appointment of Dr. J. T. Rothrock, the well-known botanist, as secretary, with the understanding that he would devote his entire time to the work. No more fortunate appointment could have been made or policy decided upon. Dr. Rothrock brought the best possible equipment to the work, and devoted himself to it with skill and assiduity. During the winter months he visited most of the counties of the State, giving illustrated public lectures, speaking before county societies, talking with numerous constituents and their legislators in so convincing a manner that before the close of the session the forestry bill had become a law. Not only that, but as a convincing proof of the sincerity of the governor's desire for the success of the work of the commission, Dr. Rothrock was appointed its botanist, and has spent the summer in the field actively prosecuting its work.

The forestry cause is one of far-reaching and profound importance to the country. A clear statement of its facts and arguments cannot be brought effectively to the popular mind without popular organizations in the various States—organizations which shall not be content with desultory work, but will be satisfied with nothing less than putting into the field a man of large calibre who shall give his entire time to the prosecution of the work, and whose efforts shall be supported morally and financially by the association which he represents. Experience teaches that there is no way so effective for prosecuting reform work as that of making strong the hands of an efficient man. It is an expensive method, but the only one. In no way can money be better spent by public-spirited men and women who long for the increase of national wisdom and labor for the promotion of the general welfare.

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The attention of members of the Association is called to the following desirable publications, of special value in bringing the scientific aspects of Forestry to the attention of their friends :

Forest Leaves, edited by Mr. John Birkinbine, 25 N. Juniper Street, Philadelphia. Official organ of the American Forestry Association. \$1.00 per year. Bi-monthly.

The New Jersey Forester, edited by Mr. John Gifford, May's Landing, N. J. Organ of the New Jersey Forestry Association. Devoted especially to the forestry interests of the Northeastern States. \$1.00 per year. Bi-monthly.

Garden and Forest, edited by Prof. C. S. Sargent, Harvard University. Publication office, Tribune Building, New York. The leading journal of its class in America. \$4.00 per year. Weekly.

Schlich's Manual of Forestry. 2 vols. Bradbury, Agnew & Co. 1889.

Nisbet's Studies in Forestry. Oxford, 1894.

These two works are technical in character, devoted to silviculture. The authors are both recognized authorities.

Apgar, Trees of the Northern United States. American Book Co. New York, 1892. \$1.00. A manual for determining the names of trees.

Houston's Outlines of Forestry. J. B. Lippincott & Co. Philadelphia, 1893. \$1.00. A popular statement of general questions.

"What is Forestry?" Bulletin 5 of the Division of Forestry, U. S. Department of Agriculture. Outlines the principles underlying forest management.

"Forest Influences." Bulletin 7 of the Division of Forestry, U. S. Department of Agriculture. A complete hand-book on the influence of forests on climate and water-flow.

Annual Reports of the Chief of the Forestry Division for 1892 and 1893. These reports contain brief summaries of the condition of the forests and the forestry movement in the United States; also a condensed statement of German forestry methods.

The last three publications can be obtained by application to the Division of Forestry, U. S. Department of Agriculture.

Proceedings of the American Forestry Association :—

Vol. VII. Meeting held at Atlanta, 1888.

Vol. VIII. Meeting held at Quebec, 1890.

Some copies of these proceedings, containing valuable papers, are still to be had at \$1.00 per volume. Apply to Secretary.

PROCEEDINGS
OF THE
American Forestry Association



AT THE
Tenth, Eleventh, and Twelfth Annual Meetings,
Washington, December, 1891, 1892, and 1893,
AND AT THE
World's Fair Congress, Chicago, October 18 and 19, 1893.

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NOTICE.

This is the fourth and last fascicle of Vol. X of Proceedings, comprising pages 141 to 183.

For non-members, the price for each fascicle will be 25 cents; the whole volume, \$1.00. Copies can be had by addressing Forestry Division, U. S. Department of Agriculture, which has undertaken to act as distributing agency for these publications.

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THE FOREST RESOURCES OF THE ARGENTINE REPUBLIC.

By GUSTAVO NIEDERLEIN, Commissioner of the Argentine Government to the Columbian Exposition.

[Read at the World's Fair Congress, October, 1893.]

Mr. Niederlein presented a very elaborate paper on the forest geography, forest botany, and useful woods of the Argentine Republic, which is to be printed in full from the Philadelphia museums where Mr. Niederlein's collections of Argentine woods have been placed.

We can here only briefly state the principal points made in the paper.

The forest zone of the Republic lies in the northern half of the country, growing richer in species as it approaches the tropics. The area of woodland is estimated at 200,000 square miles, or less than 18% of total area. Of the 500 species belonging to 200 different genera and over 60 orders, about one-eighth are Leguminosæ (like our Black Locust), and in numbers these latter form the predominant feature. Only 38 species reach a height of 80 to 120 feet. No pines are known, the Pino (*Araucaria*) being the only conifer. The Argentine woods are mostly heavy woods and excel by their color, varying through all shades.

One of the heaviest (spec. gr. 1.3-1.4) is the Quebracho colorado, which is perhaps also the most useful, yielding large quantities of tan extract, largely exported, the wood containing from 18 to 25% of tannic acid.

The absence of conifers is felt as far as materials for construction is concerned, although some 50 species adapt themselves to such use; but for manufactures the selection is very varied; outside of the Cedro (*Cedrela*), known as Argentine Mahogany, there is, however, little exported, except to the neighboring forestless countries. The entire commerce in indigenous woods, amounting to about \$15,000,000, coming especially from the Gran Chaco and Misiones territory, the northern part of Santa Fe, Santiago del Estero, Tucuman, Cordoba, Corrientes, and Entre Rios.

The woodworking industries are mainly confined to the capital,

Buenos Ayres, with 1,178 establishments, employing over 12,000 workmen, and altogether some 50,000 men are connected in some way with the wood industries.

So far the exploitation is only limited, but naturally wasteful, since the country is sparsely settled and transportation insufficient; the scattered occurrence of the different species adding another element in retarding wholesale forest destruction.

TIMBER AS A CROP.

By B. E. FERNOW, Chief of Forestry Division, Department of Agriculture.

[Read at World's Fair Congress, October, 1893.]

The object of our forestry movement is twofold, namely, to preserve favorable forest conditions where they are necessary, and to see our forest resources treated as a crop rather than as a mine or quarry from which we take what is useful and then abandon it as a waste, unproductive spot useless to man.

The idea of a crop involves sowing and planting, cultivation and harvest, and when the crop is reaped we expect that it be reproduced and the soil bring forth another crop, as good or better than the first.

Just as agriculture uses the soil systematically and under intelligent direction for the production and reproduction of agricultural crops, so does forestry use the soil systematically and under intelligent direction for the production and reproduction of wood crops.

It is not the intention in this paper to give any technical advice as to how a timber crop may be grown, but to discuss briefly some economic considerations that present themselves to him who would engage in timber-growing. A wood crop differs from an agricultural crop in that it takes the accumulation of the growth of many years or annual accretions before the crop is useful; it is not an annual crop. Hence the financial calculation of cost of production and profit in the harvest depends on uncertain factors of the future. Another important difference from a financial point of view is that the harvest is not determined by any natural period, like the ripening of the fruit or the end of the season of vegetation. It lies with the manager of the crop when he will harvest it, his determination

depending largely on questions of financial import, the quality of material which he can market, or the use to which he proposes to put the crop, and sometimes the methods by which he proposes to reproduce it. For example, if he be a consumer of wood for charcoal-iron manufacture, he would cut his hard-wood crop when it has attained the age of twenty or twenty-five years, expecting its reproduction from the stump again and again—a coppice system with 20 years rotation.

If, however, he were to grow timber for the general market, he would have to wait until his crop had attained such size as will furnish marketable material, and if he expect to reproduce the crop by natural seeding he would have to allow his crop to grow until a plentiful repeated seed production is assured; he would manage his crop as a timber forest with, say, 70 to 100 year rotation; or, if he had a market for box-boards, he might cut his white pine at thirty years, instead of waiting for its full development.

Technically as well as financially the most important distinction between grain or root crops and forest crops, and one which we must impress most strenuously upon our forest-owners, is that a timber crop may be reproduced in acceptable form by the mere manner of harvesting the old crop. If cut under intelligent direction and with proper precautions, the old crop will reproduce itself by the seed from the trees that occupied the ground, and the new crop will start with hardly any effort on the part of the man except a judicious removal of the old crop. All cultivation of the new crop to bring it to more rapid and better development and to improve its quality will then be done also by the judicious use of the axe. The axe, paradoxical as it may sound, is the preserver and cultivator of the forest—not in the hands of the lumbermen, but when judiciously directed by the forester.

If we were to engage in the business of timber-growing we could start from three different positions: either we have a soil without encumbrances, or nearly so, ready for cropping, or we have a well-stocked virgin forest ready for harvesting, or else we have a piece of woodland from which all the good timber has been culled and the poor kinds and poor timber left. Financially I should prefer the second position every time, provided the class of timber composing the forest is of desirable kinds, for with such conditions it is a question of but short time when the forest can be brought into systematic, regularly producing and reproducing condition, yielding at once interest on capital and expenditures for improve-

ments invested. But our friends in the United States—the few that venture into this business—as a rule seem to prefer the other two positions; they choose a poor culled piece of woodland to practise forestry on, as if by the magic of that misused word the cream that has been skimmed from the virgin forest would rise again; or else they plant on new ground, when one would think the expense of the planting, together with the patient waiting for many years ere the crop becomes marketable, would deter them from the attempt, unless other considerations prevail, such as present themselves in the forestless prairie and plains country.

That the more rational method would be to take the crop ready made by nature and apply systematic forest management to that, has seemingly not occurred to those who would try their hand at raising timber crops as a business.

The technical difficulties, to be sure, with such management are greater, and more expert application of forestry knowledge needed, than in planting on new ground, but the returns would not be waited for as long. The curtailment of the present revenue, which is necessary in order to secure not only a continuous revenue but also a property more valuable than it came from the hand of nature, would soon be recompensed, if the conditions are not entirely unfavorable.

Favorable conditions are a forest composed of timbers that are mostly merchantable, and of which one at least, occurring in not too small proportion, is a staple which commands a ready and unlimited market, nearness to a market, and not too great difficulties in obtaining transportation within and without the forest.

Instead of doing as the lumberman would do, culling out all the good timber, usually one kind, *i. e.*, the best, bringing it over temporary roads—as much as would promise good returns—to the mill and abandoning the property when the cream is taken, because it is not worth paying taxes—this is the way in which the State of New York has become owner of nearly a million acres of Adirondack forest—instead of thus skimming the forest, we would prepare to hold and improve the property for permanent investment. This would require, first, the knowledge of what kind and quantities of timber our forest contains and the needs and requirements of the various timbers for their growth and reproduction; then a plan of management would have to be made, in connection with which, after mapping the tract, a system of permanent roads should be laid out. They need not be built at once, but as needed, with a

view to constant use. Next should be studied how the inferior, less marketable timbers could best be utilized. These then should be cut first, judiciously, with a view of reducing them in proportion to the better kinds and of preparing a better chance for reproduction of these.

No profits may come from these manipulations, but these improvement cuttings, and preparations for continuous forest management, even if they cost, are improvements that repay themselves in the end.

When we have provided means for ready transportation, brought the forest into acceptable composition and condition, and have prepared the way for a satisfactory reproduction of the best timbers, then we begin to cut the latter, always carrying on operations with caution and with a view to the needs of each species, so as to secure a new crop, reseeded from the old, before the latter is entirely removed.

You see that forestry does not consist in leaving trees, but, on the contrary, in cutting every one; but when the old crop is all cut, a new one, more valuable than the old, is growing. The lumberman's cutting is usually the very opposite; he does not, as a rule, take everything, but culls the best, leaving the undesirable, and thereby he prevents desirable reforestation, so that he leaves the forest in worse condition than it was before. We admitted that part of the harvest is perhaps not profitable, but the loss must be charged to the improvement and greater value in which we find our property after the operation.

You will also observe that nothing has been said about cutting annually only a certain amount of timber. It is a mistaken notion that therein consists the keynote to European forest management. To take only that which grows annually—the interest on the capital, as it were—is proper financial management but has nothing to do with forestry. The amount to be cut, as far as forestry is concerned, is only dependent upon the needs of the aftergrowth. Hence it is unlike from year to year rather than like, and the very difficulty of the manager is to reconcile the financial and the forestal requirements. The same difficulty arises when the need of thinning the new crop, in order to bring it to more rapid development, is recognized, but the impossibility of marketing the inferior material forbids the operation from a financial point of view.

The question whether timber-growing is a profitable business cannot, of course, be answered as a general proposition; it can only

be answered under special given conditions ; but I submit that if it can be made profitable at all in the United States at the present time, it is more readily made profitable in the manner indicated than in any other. If it is not possible to make timber-cropping profitable by buying as a start a well-stocked virgin forest, accessible to large markets, for \$5.00 to \$10.00 per acre, land and timber, containing a full-grown crop of at least 50% of valuable forest, what should we expect from timber-planting, which can certainly not be done at less than \$10.00 to \$15.00 per acre in addition to the value of the land, and must wait for returns until the crop is ripe for the axe, compounding the expense all the way from 30 to 100 years, as the case may be ?

It is to be hoped that some of our lumbermen and capitalists in whose hands the fate of the forest property of the nation lies may study the possibilities of managing it profitably for continuous timber crops. I am convinced that the time has arrived in many instances when this can be done without detriment to the pocket of the investor, and perhaps with an increased profit, even, during his lifetime.

In this connection I wish to call attention to some important considerations regarding the profit calculations in such a business. Not only is there no safer and, for the large capitalist, more agreeable investment to be found than timber lands ; not only can he regularly and at will draw his interest, and, if he chooses, anticipate the same, taking advantage of favorable market conditions, but he will have an investment that is capable of increasing its yield partly by increased material product under management and partly by increased price for the same. In Germany the price for wood has increased during the last 30 to 40 years at the rate of 1.5 to nearly 3% per annum. In Prussia the price nearly doubled in the years from 1830 to 1865, while in the 40 years from 1850 to 1891 it rose 59%, or from 3 cents to nearly 5 cents per cubic foot of wood of all kinds and sizes. And while the cost of management increased also, yet during the years 1830-'79 the net yield of the Prussian State forests increased at the rate of 1.36% per year, in Saxony from 1850-'79 at the rate of 3.02%, and in the Bavarian forests at the rate of 3.14% per year.

These experiences, which are bound to repeat themselves in our country—in fact, have already been had here and there—teach us that, in calculating profits on such investments, we are justified to apply a lower rate of interest than is usual. Interest charges, as

we have grown richer as a nation, have begun to decline, and if Government bonds, on account of their safety and the ease with which the interest is collected, bring only 4% and less, the compounding of interest charges on forest property, which is as safe, and increasing in value, may be done at even a lower figure without involving financial miscalculation.

In conclusion, while, as we have said, the usefulness of a timber crop arrives many years from its start, it nevertheless has a value at any time, just as the colt has a value derived from the promise of its future as a mare, and as surely as virgin forest supplies are being consumed at a rate which exceeds twice the capacity of the existing area to produce, as surely will thrifty growing timber increase in value.

Now is the time for the long-headed lumberman to begin to treat his timber as a crop!

RELATION OF FORESTRY TO THE LUMBERING INDUSTRY.

By MET. L. SALEY, Editor *North Western Lumberman*, Chicago, Ill.

[Read at the World's Fair Congress, October, 1893.]

The "Relation of Forestry to the Lumbering Industry" is practically, so far, very meagre. In the hard-wood districts, when a mill man hunts up and buys trees which will produce exactly the kind of stuff he desires, cuts, hauls them to his mill and saws them, he is following the teachings of forestry, though nine times in ten unwittingly. So, in the yellow-pine fields, when a saw-mill man has an order for timber, and selects the trees from which the sticks may be sawed to the best advantage, he is carrying out some of the ideas of the forester. Forestry, in the sense above designated, as I understand it, means the handling of timber to the best possible advantage, due attention being paid to the matter of selection, the prevention of waste, and the preservation of young trees. Any one acquainted with American lumbering methods knows they are not hampered with any such conditions.

Between the great bulk of lumbering business and forestry there is at present no actual relation, and it may be readily seen why there is none. There is no more rushing, pushing business than

the manufacture of lumber. Great bodies of timber are cut as rapidly as possible and fed to the saws. It is a sweeping wholesale business, and the lumberman in pursuing his work has an eye as single to the job before him as has the big Western farmer when superintending his harvesters, intent on gathering his thousands of acres of wheat. The saws are run strictly on business principles and for the purpose of putting the last dollar possible into the pockets of the men who operate them. Connected with forestry, as so far conceived by many of its friends in this country, there is sentiment, but there is little of that article touching his occupation harbored by the lumberman. He is not in the business for a lifetime, much less for the benefit of future generations. Ask the majority of manufacturers, and they will say that in five, eight, ten, or a dozen years, as the case may be, their timber will be exhausted and they will then retire. It is easy to understand, it appears to me, why a man doing this rushing business for the purpose of gaining a competency in a few years should not seriously consider the question of forestry or any other question, especially when the working of it out would tend to block his operations. Interest is the great motive that controls all of us, and in forestry the lumberman feels no direct and immediate interest, the present only being considered.

City people, to whom forests are poetry and a comfort, are quite unable to understand the subject from the standpoint of the lumberman. Those people read in the press thrilling accounts of disastrous forest fires—as a rule more disastrous in print than in reality, for which let us be thankful—and rightly regard them as calamities, as frightful cancers which eat away and blacken sections of the fair face of nature. They little know, however, that this great sin against forestry—forest fires—is condoned by the lumberman. Few things affect his interest more directly, one would think, yet apparently it is a matter of supreme indifference to him whether forest fires rage or not. When he has seen them coming full headway for his mill, or the town in which he lives, he has been frantic in an attempt to assemble his neighbors for the purpose of trying to extinguish the flames. But what pains have been taken to prevent these fires? In the white-pine territory, where they are most destructive, not only to timber but to settlements and human life, I have never known but one operator to burn his debris under supervision, and thus protect his own property and that of his neighbors. Often any kind of protection would be of no value to the operator who has laid the train which, sooner or later, will be fired. He has cut

every stick of valuable timber of his own, and the timber standing next to his leavings belongs to his neighbors.

Here comes in the legal aspect of the case, and it is most surprising that the courts have not been asked to give their opinion regarding it. In common law, if a man desires to pile, without protection, combustible material on his lot adjoining one on which stands a neighbor's house he may do so, but he will be held accountable, in case of damage, for such loss as might naturally result from his negligence. If an operator permits the leavings of a logging job to collect and dry alongside of the timber of another man, there is little question but in law the operator would be held responsible if the timber was damaged as a result of the fire originating in the powdery brush-heaps. Yet so universally is it held in logging circles that forest fires are a natural consequence that never, to my knowledge, has a suit been brought for damage as a result of one. If there is the slightest suspicion that sparks from a locomotive or steam-tug set the lumber in a yard on fire, litigation is sure to follow; but if a man permits his inflammable refuse to accumulate, and as a result there is a sweeping conflagration that does more damage than half of the lumber-yards in the State are worth, not even blame attaches to him. This utter disregard of this phase of forestry—the prevention of forest fires—is as deplorable as it is unaccountable. The plea of the operators is that it would not be possible to so care for their debris that the great danger of forest fires would be materially lessened. They really mean, when they say this, that the expense of such care would be greater than they would like to bear.

It is not surprising that little thought was given to the preservation of timber by the men whose names are prominently recorded in lumber literature. Few can see beyond the horizon, and these men knew not where the great stretch of forest ended. The reports of the Government surveyors were not in. The land looker who has since compassed the timber world had not won his laurels. More now is known of the timber supply. There is timber in large quantities—in the South, on the Pacific coast, and even as yet in the white-pine States—but reflect how insignificant the amount when the demand is considered, and when we are aware that the present enormous consumption, on the basis that population increases 1,000,000 a year, will increase at the rate of 500,000,000 feet annually. There is enough timber for us during our remaining years, but with each of us it should be a sacred wish that this great nation, of which we are a part, may live on and on for centuries and prosper; and

how much it would add to that prosperity could it all along have at hand the great and rich timber resources which it has been able to command since its life began. But those resources it will not have. At the present rate of the manufacture of lumber, allowing 6,000 feet of timber to the acre, an area is stripped yearly equal to that of Vermont, New Hampshire, or Massachusetts. This is for lumber and shingles alone, and does not include the output of timber for fuel, mining, or railway track purposes. We have children who will see the great forests of the United States, excepting perhaps those of the extreme west, practically cut away. What then? You answer, and see if you can derive consolation from any answer you may frame.

Regarding this brittle and almost imperceptible thread that at present unites forestry and the lumber industry, we should bear in mind that forestry in this country is a comparatively unknown subject. Possibly, were lumbermen to know more about its advantages and possibilities, they would at times profit by it to a greater extent than they do.

In the future there will be a decidedly intimate relation between forestry and the lumbering industry, but it will be when the hum and clatter of the great commercial mills will have nearly died away, as then there will be but few great bodies of timber from which such mills may be fed. As men now plant corn and wheat for food, so by and by they will plant trees for the needs of their children and their grand- and great-grand-children. How to cultivate trees will be taught in our colleges and universities, and the true relation between forestry to the lumbering industry—the one providing the crop which the other utilizes—will be established.

RELATION OF FORESTRY TO LUMBERING AND THE WOOD-WORKING INDUSTRIES.

By J. E. DEFEBAGH, Editor *The Timberman*, Chicago, Ill.

[Read before the World's Fair Congress, October, 1893.]

As the purpose of this congress is to develop a complete and comprehensive view of the subject of forestry in its two correlated departments of forest preservation and forest culture, through the presentation of various phases of the subject by men of practical

knowledge and experience in them, I have been asked, not as a practical lumberman, but as editor of a newspaper of the lumber trade in touch with all its branches, to treat of this peculiarly practical and matter-of-fact topic, "The Relation of Forestry to Lumbering and the Wood-working Industries."

What I shall have to say must be in the nature of an explanation and partially of an apology. The individual lumbermen and wood-workers as such have no interest in the subject of forest preservation and culture. As citizens, and therefore interested in all movements looking toward the good of future generations, they may give attention to the considerations you would urge, and assist in the furtherance of your objects, but as business men you cannot appeal to them. This being the fact, as I shall show later, why then consider the relation of forestry to them? Why not at once drop this branch of the subject? Simply because the reasons why lumbermen are not directly interested are economic and financial ones on which hinge the possibility of accomplishing your purposes, and a brief statement of them may more clearly set before forestry specialists the practical difficulties with which they will have to contend in this country, and therefore more fully arm them in advance for the battle which must be waged for more than one generation before their laudable objects shall be fully accomplished.

Much invective has been wasted in denunciations of the attitude of lumbermen towards the forestry problem. To those who attend forestry congresses or read the literature concerning the subject, which of late has occupied so conspicuous a place in the public press, no phrase is more familiar than this, "the ruthless destruction of our forests." That word "ruthless" seems to define the mental and moral attitude of the lumberman towards the subject under consideration. So violent and unreasonable, in many cases, have been the charges against him that the lumberman has often been forced to an attitude of apparent hostility, that misrepresents his real feeling, which is one of entire indifference. The invective is misdirected and wasted, because the lumberman, as such, is not any more responsible for the bad results of his business than is the banker, the grocer, or the farmer. He is but part of a commercial and industrial system the blame for which must be divided among the fifteen millions of our voting population, and comes even to them as an inheritance.

The time was when a great part of the territory of the United States was under control of the Government—that is to say, of the

people as distinguished from individuals. Then was the time when great bodies of timber-bearing lands might have been forever set aside to public uses, or transferred to private hands with a reservation as to the use that should be made of them. But no such policy was adopted, the public domain became private property, and the very basis of our political and social organization is the basis of these property rights, which cannot be disturbed without a revolution in the accepted order of things, which will not be effected in this generation, if ever. Private property must be taken if adequate timber reservations are to be secured.

I do not forget the timber reservations which the General Government and States have established, but they are so small in comparison to the whole area of the country and to the great results to be subserved by forest preservation and reforestation that in this discussion they can be ignored. It is gratifying that in California and other States great reservations have been made which will prove of inestimable advantage to the people; but the forests covering the head waters of the great rivers of the East and of the interior are already in private hands. The most vital points present the greatest difficulties to those who would preserve the forest cover. It is, according to forestry theories, of the utmost importance that the head waters of such rivers as the Mississippi and Ohio, with their chief tributaries, should not be denuded of their shade, and yet it is just these birthplaces of the rivers that are most completely under control of operating lumbermen or investors, and which it is least practicable to bring again under the control of the Government on account of the cost.

I lay down this proposition: that it is not within the power of the General Government to preserve any such portion of the virgin forests as would result in any substantial benefit, for the simple reason that even the resources of this rich Government would fail in an effort to purchase the timber cover of the head waters of these streams, and the Government is restrained by its very nature from taking possession of them without due remuneration to their present holders. The question may be asked if the Government cannot consider timber holders who produce by the use of their property a condition of things damaging to the best interests of the whole people and of future generations as having no right to such possessions, and to practically confiscate them.

Let us look at the situation from the lumberman's standpoint. The Government, which was formerly the owner of the immense

forests of the central and western portions of this country, in which lumbering operations are now most actively carried on, put these timber lands upon the market at an inviting price. Immigrants were wanted, settlers were wanted, and all facilities were put in the way of those who would develop the natural resources of the country. Therefore, the man whose education or inherited aptitude made him a lumberman purchased these lands, proposing to utilize them, or is now in possession of them after they have passed through many hands since the original purchase, at a price due to the years of accrued value. The present holder has thousands, possibly millions, of dollars invested in lands, in timber, in appliances for bringing his timber to a point of manufacture, in mills and all the other paraphernalia for the conduct of what is known as the lumber business, for the production and sale of a merchantable commodity which is demanded by the people of the country. He has been encouraged by the nation, by the business customs of the community, and by the demand of the people at large; for the lumberman is the home builder, and with the railroad and the frontier settler has been, and is, the pioneer of our American civilization. His operations have made the settlement of our prairies possible. The history, law, customs of the country, all justify his ownership and secure him in it.

It is unfortunate that the amount of standing timber in the United States is not and cannot be known, but to illustrate the magnitude of the task which the Government would undertake, in establishing the forest reservations at the head waters in the white-pine country of Michigan, Wisconsin, and Minnesota, of such magnitude as to really accomplish the results at which forestry advocates aim, let us assume that there is only 50,000,000,000 feet of standing pine timber still left in those three States. There is undoubtedly a much larger amount than that, but if that were all, and if it were valued on the average at only \$3 per thousand feet, board measure, it would make the total value \$150,000,000. It is the common belief, largely justified by the facts, that the white pine is almost gone, and in truth it is only a fragment of the original forest which still stands. So small is even this great amount that much more land than this would be necessary to give a proper amount of forest cover to the head waters of the Mississippi and the streams that supply the great lakes, and that is only one of many important sections where the same work is to be done.

If we admit that absolute ownership by the Government is im-

possible, what shall we say as to the practicability of establishing such regulations for the use of timber as would preserve the forests still standing, allowing their owners to only cut mature timber, and by careful treatment to preserve the life and usefulness of the forests perpetually? It is a question if such a measure as this comes within the province of the Government of the United States; but, on the ground of eminent domain, right might be established either in the general or State governments. The lumbermen would have no objection to such supervision if they could be assured that their competitors in all sections of the country would be treated alike, and provided, also, that they were reimbursed for the loss of value which would be occasioned thereby. But here, again, there are many factors to be taken into consideration. Take the individual operator and consider the circumstances under which he is doing his business. He is in the lumber business to make money out of it if possible.

In the white-pine region of the Northwest the cost of timber to a man who is now operating has been so great that it is only by the utmost economy of operation, the most careful manipulation of the product in the mill and on the market, that he is able to make a reasonable profit. These conditions lead to methods of operation which under ideal circumstances would not obtain. In order to get his logs from the forest to the mill in the most economical fashion, and to fully utilize his investment in standing timber, he must cut his land clean as he goes. Everything that will pay for transportation and manufacture must go through the mill, for the fixed charges of a small logging operation are almost as great as a large one, and it costs but little more to take all the timber above eight inches in diameter on a tract of land than to take merely the matured trees. Moreover, the lumberman is threatened constantly by multiplied dangers. He is more keenly alive to the ravages of forest fires than is any forestry enthusiast, for he not only has a sentimental interest in them, but a practical one, as they may wipe out a property which represents years of active business life.

The lumberman, as an individual operator, cannot afford to clean up his lands after him. To gather the debris from his logging operations together and burn it safely would cost so much as to put him out of competition with his neighbor. Moreover, if he were to adopt such policy, the danger is not much lessened, for he is surrounded by other operators who may be less careful than himself. Further, the forest is honeycombed with the clearings of set-

tlers, who are more anxious to put their land in shape for tillage than they are to preserve the timber holdings of their neighbors. The timber-owner is threatened not only with this danger of fire, but other perils which are entirely natural and exist in any primeval forest, and with others which necessarily accompany lumbering operations however carefully they may be conducted, and the settling of the country by agriculturists. A clearing made will deaden the timber for some distance around it; rot and insect pests accompany the settler as well as the lumberman. Under the present circumstances, therefore, the lumberman in the majority of cases could not, if he would, conserve his possessions, but must transfer his forest holdings as rapidly as possible into commercial products, which in turn can be transformed into some other form of wealth. It is evident that little can be expected from the lumberman or timber-owner who depends upon that business for his livelihood in the direction of conserving the forests, simply because it does not pay him.

If, for instance, a tract of 100,000 acres virgin timber land in Wisconsin, with 7,000 feet, board measure, of pine per acre—a stand above the average—were bought for \$5.00 per thousand feet, the capital thus invested would be \$3,500,000.

The cost of conducting the lumber business from the tree to the market may be estimated at \$7.50 per thousand feet. Assuming the high average price of the product at \$15.00 per thousand feet, the profit would be \$7.50, which could be realized as quickly as the market will allow. But if the tract is to be kept in perpetual production, the cut is limited to, say, 20,000,000 feet per year, and the expense of improved methods and care increases so that we can only assume a profit of \$6.00, the total net profit of \$120,000 would represent less than $3\frac{1}{2}$ per cent. interest on the investment.

The conclusion, so far as the lumberman is concerned, seems to be plain and inevitable—that it is not, under present conditions, within his power to carry out any policy of forest preservation or culture; and that whatever is to be done must be by the people as a whole, with due regard to the property rights of the individual.

A word as to the relation of the wood-worker to this question. Directly he has nothing to do with it, for he purchases his materials in the open market, and if such forestry measures were adopted as would raise the price of them, his competitors would be equally affected and his comparative position remain unchanged. But here enters a consideration that from a politico-economic view should

not be ignored. What would be the effect of a considerable increase in the value of our forest products on the multifarious form of enterprise into which they enter? What would be the result to the already heavily burdened farmer of the West if his houses and barns, and his agricultural implements, and the wagons and railway cars in which his products are transported were made more costly? What to our furniture exporters, if a substantial increase were made in their chief material? What to our oil export trade, if cases and barrels advanced in price? What to the paper trade, if wood-pulp were difficult to obtain? But the list is endless.

Here I wish to state what seems to me an axiom. I do not venture to claim originality for it, and yet I do not remember to have seen it in this form. It is this: No nation can husband a chief resource. If I am right in calling this an axiom it should not need explanation or amplification, but I am tempted to illustrate it. A chief natural resource must be comparatively plentiful and cheap. It is that in respect to which one country is superior to another. If its comparative cheapness should be artificially done away with—or, in other words, if the natural effect of its plentifulness should not be allowed to occur—then it would at once cease to be a chief resource. The United States is an exporter of wheat because of its vast area of natural wheat lands, valued at a low price, on which wheat can be cheaply raised. If the wheat-raisers were required to maintain the strength of the soil by artificial means the advantage would be lost. Similarly with the cattle trade. If the ranchman of the plains were required to breed and care for his cattle after the English fashion, we would no longer be able to supply Europe with cheap meats. So with forest products. If the lumbermen were obliged to adopt German methods of forestry we could not longer occupy the superior place we do in the markets of the world.

Conversely, where wheat lands are scarce, fertilization is profitable; where grazing lands are limited, the quality of the products can make amends for the small quantity; where the forest area is small in proportion to population, forest culture is feasible.

Where men and not materials are the chief resource of a country, there men are cheap; where natural resources are abundant in proportion to population, there these resources are cheap and men are dear.

The difficulties in the way of an adequate forestry policy in this country are thus seen to be financial and political, and are expressed very clearly in the relation that forestry bears to the lumber and wood-working industries.

It would be somewhat ungracious, as well as unfair, to close this paper, so occupied with arguments against the practicability at any early day of putting into effect an adequate forestry system, without mentioning some directions along which effort might have more chance of success.

In the first place, the illustration chosen of operations in Wisconsin is an extreme one, and yet justified by the fact that the most important head waters of the Mississippi lie in that State and in Minnesota. In some other sections conditions as to value of timber and methods of conducting the lumber business are very different. The whole Southern lumber industry is conducted on a much lower valuation of timber, and in hard-wood regions, like that great cradle of rivers, the mountain section of Kentucky, Tennessee, West Virginia, and the eastern parts of Virginia and North Carolina, operations are now conducted in some respects after the method which would prevail under supervision of a Government forestry department. There is no such clearing of land as prevails in the white-pine country. The timber is largely treated as individual trees instead of in masses, and is often purchased separate from the land.

In the particular section referred to, it would be comparatively easy for the Government to obtain sufficient control of the forests to accomplish direct results in preserving the forest cover. The chief difficulty would be with the small farmers and mountaineers, who have but little regard for property rights in standing timber, whether those rights are exercised by Government or by individuals.

Opportunities to establish timber reservations in the white-pine region of the Northwest at a non-prohibitory expense arise as the lumberman finishes his timber-cutting operations. There is then left but little that is, under present conditions, of value. In multitudes of cases the lumberman abandons his denuded land, which eventually is sold for taxes. Millions of acres of one-time pine lands can now be bought in Michigan and Wisconsin at not to exceed \$2 per acre, and in many cases the State could secure them on remittance of taxes. There is much of this land that is either worthless for agricultural purposes or of so little value that the population of the country must be much more dense than it is now to encourage its use.

On these abandoned and barren tracts a grand experiment might be attempted in the culture of white pine (*Pinus strobus*), a tree whose superior in general utility does not exist, and which, under

present conditions, is fast disappearing. It is a firmly held belief among lumbermen that the white pine cannot be reproduced on the soil it once occupied in great forests. But I believe that scientific methods would avail to reforest the plains and hills of the Northwest with this noble wood, and prepare for our children's children a vast storehouse of forest wealth that would remain for all time.

THE RELATION OF RAILROADS TO FORESTRY.

By HOWARD MILLER, Gen. Agent Union Pacific Railway.

[Read at World's Fair Congress, October, 1893.]

The successful agriculturist is one who raises a crop and has in mind not only its immediate disposition, but the continuation and improvement of the conditions that rendered its production possible. There is no more elementary fact in the hornbook of the husbandman than that he may not take from the earth without corresponding return of measure and kind. Robbery of the earth entails certain beggary not only upon him who takes, but upon the earth itself. He may overdraw on Nature's bank, but sooner or later his drafts are protested. We speak of inexhaustible fertility, but there is no such thing in nature. Like unlimited credit, it is only a phrase embodying a later day of reckoning.

The centuries have taught the most illiterate that if he would reap he must sow; that there can be no succession of harvests without previous seed-times. As palpable as this fact is, as far as the individual is concerned, it is all the more remarkable that the State is just beginning to recognize it as equally applicable to the higher forms of vegetation. No man listens to the whirl of the reaper without a knowledge of the drill that preceded it, and which must follow to ensure the next crop. Yet most men will hear the echoing thud of the woodman's axe, the crash of falling timber, and view the busy mill scene without a thought of the restoration nature will exact if want is to be kept from posterity.

It argues ill for our intelligence that we view with regret the barren field that has been cropped to sterility, and look with complacency on the denuded forest where once, within our recollection, were Gothic arch and "God's first temples." The man with the

axe lays low the gift of a century, and usually has thoughts about it differing as little from those of his prehistoric ancestor as their tools of destruction vary in form. No border clan ever returned from successful foray and left behind such a blank array of material destruction as the logging camp on the edge of the stream leaves the next generation.

The existence of the industries that live directly and indirectly through this slaughter is not deprecated. On the contrary, they are the necessary concomitants of civilization and progress, but it is in the thoughtlessness for the future that not only the scientist but the political economist finds food for grave reflection. The end of the forests of this country is in sight. Whatever bears on their destruction is of equal importance with the facts relating to their perpetuation and preservation. Of all the destructive and insatiable agents contributing to the depletion of forests, perhaps none are more voracious than railroads. Before a wheel can turn a tree must die. Every railroad in the United States represents the death of a forest, the extent of which is not apparent on first thought.

In round numbers, the railroads of the United States represent about 225,000 miles, with the annual addition of about 5,000 to 6,000 miles of new road. These roads require not less than 2,500 ties to the mile. A good tie is not less than 8 feet in length, and a tree 1 foot in diameter and 25 feet from the ground to the first limb would cut from its trunk 3 ties. This estimate is lower all around than the facts in practice. The totals are sufficiently appalling at these modest figures. A forest of 800 trees would probably furnish ties for one mile of railroad, and at this rate the railroads of the United States would require 180,000,000 forest trees of the most valuable kinds for ties alone.

The life of a tie varies, but may safely be placed, at the very outside, at 10 years, when, owing to increased mileage of track, more than 180,000,000 trees of the dimensions named will again be required to relay the roads. Of course, this renewal every 10 years is not literal, yet each year sees not less than 10% of the ties replaced, and at the end of the period not less than 180,000,000 forest trees find their graves under the iron highway. These enormous amounts confuse the reader, and to summarize in such a way as to render intelligible the results, it may be said that the railroad construction of the United States has used up one-fifth of the forest area of the country.

A U. S. Government report of 1887, on a basis of 187,500 miles of track, much too low for the present year, estimates the amount of timber used by the roads, for ties alone, and at present undergoing decay, at 1,485,000,000 cubic feet, and for the same mileage of track 375,000,000 cubic feet for bridge and trestle timber, making a total of 1,860,000,000 cubic feet. Add the telegraph poles and other timber used by railroads, and the forest necessary to furnish the annual consumption by its annual accretion would measure 100,000,000 acres. (See Bulletin No. 1, Forestry Division, United States Department of Agriculture.)

It would appear on first consideration that the supply of ties at the present would be so diminished as to be a source of alarm. On the contrary, the supply is equal to the demand, and the prices are not much higher, if any, than heretofore. This does not mean an increase of forest area. It results from the division of the land into smaller holdings and the incident clearing of timber land by the purchaser and the consequent offering of ties to the nearest railroad. Then the south, with its vast forest area, and cheap land, and cheaper labor, furnishes great numbers of ties at prices which fairly compete with the northern-grown product. Of course, the end of all this is clearly in sight.

Recognizing the eventual commercial value of a substitute for wooden ties when they are no longer available, the inventive genius of this country has produced 516 patents of metallic ties and stringers. They have not met with general favor from corporations because of their great initial cost and their imperfections compared with the perfect wooden tie which holds the alignment of the road, and possesses the elasticity and noiselessness sought. That this is the case now does not imply that in the future the iron or steel tie may not supersede the wooden one. In fact, it is not generally known that there are over 30,000 miles of railroad operated on metallic ties. Experiments have been made on the New York Central Railroad where, for three years, 800 ties have been used on the main track with great satisfaction in every respect. The 800 cost \$25.00 for maintenance in 1892. This road has 18,000 metal ties which it expects to place in the main track this season between the Grand Central Station and Harlem river.

The solution of the timber question as related to railroads clearly lies in the substitution of metal for wood, and, when the economic conditions compel attention, metallic ties will doubtless come to the front as the proper and natural material to take the place of wood.

Nothing better illustrates the field open to practical statesmanship than a picture of actual conditions that may be seen any year in the United States. In the eastern portion of the country, in a forest that sheltered the red man, the rugged oak and the sentinel pine crash to the earth with shattered limbs and broken heart at the stroke of the axe in the hands of the woodsman. From the fallen trunk are shaped the railroad ties that feed the insatiable juggernaut of the vegetable world. The limbs and debris of the woeful ruin are heaped in piles, and when the night is calm the skies are red lit with the burning brush in the clearing.

A thousand miles westward a man sits by his door unsheltered by vine or tree. Soil of unequalled fertility is about him in every direction. The iron highway stretches away in the distance across the prairie, bearing its burden from ocean to ocean, but for a hundred miles not a tree is in sight. Earth and blue sky join hands in the horizon, but the shadows on the buffalo grass are those the clouds make. In his stove and on his hearth blazes the yellow corn, for there is nothing else to burn. The man in the eastern forest strove with his axe that he might fill the meal barrel in his home. The man on the plains strove with his plow that he might harvest the yellow corn, and now he burns it for lack of wood that the railroad tie-maker destroyed in an hour. Between the two the iron highway leads. It is a necessity to both. It is indispensable, yet there exists between the two sections a disparity of resource that may well awaken thought and suggestion of remedy.

If it were possible for the average railroad corporation to engage in the culture of timber for its own uses, there are sections of the United States where such a course is practically impossible. It is not likely that any railroad corporation will engage in the culture of timber, it being cheaper to buy from those who have to sell than to engage in production. If such a period does eventually arrive it is not yet in sight. In fact, with some roads the practice on the purchase or acquirement of a piece of woodland is to give the timber to those who will cut it down and take it away.

Laying aside all diplomatic verbiage and setting forth the facts with photographic accuracy, it may be broadly stated that railroad managers, as a rule, do not care for the future of forestry as much as for the returns of to-day. A railroad corporation is not a charitable organization, nor is it in the field for philanthropic purposes. It is organized upon the basis of money contributed in large and small amounts, in the hope of profitable and immediate returns

upon the investment. The management is in the hands of men deemed peculiarly fit to produce the results sought. Their tenure of office is dependent on reduction of expense and expansion of income. The writer believes that any railroad management in the United States, acting for a moneyed constituency, which would set aside any considerable portion of the company's funds for the purchase of land and the culture of timber with the consequent expense and waiting for years for even partial realization, would find itself promptly set aside for men who would create dividends to-day for the present living stockholders and leave the next generation to take care of itself. The situation is neither defended nor deplored. It is stated for the fact that it is.

In the prosecution of any great public good, the roots of which lie in present inconvenience, there must be back of it one of two things, either the understanding and good-will of people affected thereby to the extent of co-operation, or some very drastic compulsory legislation, and before any really active work can be expected from corporations in the line of timber culture, a vast deal of missionary work lies between the idea and its consummation. This fact does not arise from any lack of intelligence on the part of corporate management, but is caused by the refusal of that sensitive entity known as capital to surrender any present certainties for future benefits to people yet unborn. The situation may be, and, undoubtedly is, a sad commentary on civilization, but it is the hard fact against which the tree man, working *pro bono publico*, must contend.

THE RELATIONS OF THE STATE TO FORESTS.

By JOSEPH B. WALKER, Concord, New Hampshire.

[Read at World's Fair Congress, October, 1893.]

The forests are among the most important resources of most of the States, and each is in duty bound to protect these as well as any other destructible property. One of the greatest dangers to which these are exposed is fire.

In 1880, forest fires swept over 10,274,089 acres in the United States, causing a loss of \$25,462,250. That these occur to a greater or less extent every year is due to the fact that no sufficient means are instituted to prevent them. The individual owner may be ever

so careful, yet, if his woods are exposed to the dangerous practices of careless neighbors, hunters, campers, and others who do as they like, he is helpless and liable to suffer serious loss at any moment.

Prevention of fire is to be found in the enactment and enforcement of wise laws upon the subject by State authorities. If such, where they already exist, are found ineffective, it is quite often due to the insufficiency of the penalties which they provide and to a public indifference to the injury or destruction of wooded property by fire. This indifference will prove surprising to any one who will give to it a little attention. He will find that, while the burning of an isolated structure worth five hundred dollars, or even less, will draw together a large collection of people, the conflagration of a timber lot worth five thousand dollars, or much more, on the confines of that town will be of but little interest to any one but its owner or to the proprietors of adjoining lots endangered thereby.

A recent experience of the writer illustrates this general apathy. A fire which broke out on the edge of a wood lot belonging to him endangered a small cottage and barn near by. An alarm was given, and one or two fire companies responded. When they had extinguished all fire near the buildings, and so wet the ground as to avert further danger, they considered that they had done all required of them, and made preparations to leave the scene, although the fire was still raging in the woods close at hand, and liable, if not extinguished, to run over a thousand adjoining acres. When remonstrance was made and a detail asked to aid in the fire's arrest, the foreman replied that he was unaware that he was authorized to fight a fire in the woods. An explicit demand for help, on the ground that the property then burning was taxed towards the support of the department which he represented, was required to secure the aid asked for. But this foreman could hardly be blamed, inasmuch as he faithfully reflected the prevailing indifference of the public opinion around him. Since this occurrence, however, the attention of the general court of New Hampshire has been called to the subject and a statute enacted in which provision is made for the better protection of forest property.

If it be objected that the wooded sections of a State are generally sparsely populated, and that efficient protection may prove difficult, it can be said, in answer, that the ægis of a State is commensurate with its utmost limits, and that it is no more difficult for a fire warden to discharge his duties in such localities than it is for a county commissioner or deputy sheriff to execute his.

Thus far there has been no such thing as forestry in this country. Until recently the need of it has been but little felt. Statistics show that our primeval timber supplies have not yet been exhausted. Nature, too, has been and is reforesting many sections formerly denuded, wholly or in part. But the time is not distant when a more rational treatment of our forests will be absolutely essential to a home supply of wood and timber.

The States should be the first to see this fact and to provide means to secure it. One or more schools of forestry like those abroad should be instituted by each, or special courses for the teaching of its principles and practice established in existing institutions. This would result in a speedy improvement of the management of wooded property, and in season, perhaps, to save the country from the timber famine which it is sure to experience if the present reckless system of forest destruction is continued for another generation. Our woods are yielding under nature's tutelage but a fraction of what they might produce under skilful culture. It is as idle to trust for a satisfactory crop of timber to nature's capricious sowing of the necessary seeds as it would be if one sought in that way a crop of maize or wheat. God's primal curse of the ground evidently meant that it should thereafter yield its highest returns only in response to man's wise control of its potencies.

We do not hesitate to urge the acquisition by States of tracts of forest to be held for the conservation of their water power, the amelioration of their climate, the preservation of their scenery, and for the instruction, largely by object-lessons, in good forestry of their people. Aside from the benefit thus derived, these may be made to yield a fair return upon their cost and maintenance.

Some three years ago a bill passed the New Hampshire senate, but failed in the house, directing the Forestry Commission to consider and make a report to the legislature at a subsequent session upon the advisability of devoting to a State park that part of the White Mountain region known as the Presidential Range, in which are situated Mount Washington, Mount Jefferson, Mount Adams, and Mount Monroe, with their foot-hills and intermediate valleys, occupying an area of some thirty square miles. While to many the proposition may have seemed chimerical, its realization at a date not distant should not be surprising to such as are cognizant of the fact that ten millions of people, and more, live within a twelve hours' ride or less of this locality.

Were all the scenic attractions of this region made accessible to view by additional paths and roads, the present large number of visitors would be greatly increased. Were the principles of an enlightened forestry applied to the management of the great forests concealed in its recesses, they would yield fair pecuniary returns and continue to serve the other offices which they now render.

In each State suitable forest reserves in which well-kept roads and paths render accessible fine views and streams, quiet valleys and mountain summits, as well as dense forests kept perpetually attractive by intelligent care, might be made very largely, and perhaps entirely, self-sustaining, and would furnish a blessed sanitarium to the thousands who would be sure to frequent them. But such must, in most cases, be established and maintained by the particular States within whose limits they are situated, and as State possessions.

Every State should have a well-digested code of forest law. Until such has been provided, the treatment of its wood and timber lands will be irregular, and very often adverse to the interest not only of the public but to that of the private owner as well. But such a code cannot be devised and enacted at once. It must embody the suggestions of local experience and grow to perfection by degrees, just as the irrigation codes of southern Europe and the railroad codes of this country have done.

The devise of such a code is the more difficult inasmuch as our forests are generally the property of private owners, and to a small extent only belong to the State. The State of New Hampshire does not own a single forest acre. When, therefore, individual owners see fit to pursue a course of management which may be detrimental to the other great interests of the State, and its protection is invoked, intricate questions will be likely to arise, to the temporary perplexity, perhaps, of its courts. And just here it may be said that this Association will confer an inestimable benefit upon the forestry interests of this country by preparing and scattering broadcast a digest of the forest laws of the several States so far as such exist to-day. Imperfect as these may be, they are American and suggestive. Side by side with those of older countries, they would aid greatly in the construction of a system for general use with us. It would be unwise to copy without careful examination laws that have grown out of the experiences of peoples living under different traditions and differently ruled. Ours must be American and answer the demands of the new environments of a new people.

THE BEARING OF ARBOR DAY AND VILLAGE IMPROVEMENTS ON FORESTRY PROBLEMS.

By B. G. NORTROP, Clinton, Conn.

[Read at World's Fair Congress, October, 1893.]

Arbor Day and Village Improvements are wisely grouped together in our program, for both alike aim to benefit the school, the home, the town, and the State. The former was started in Nebraska in 1872 by Hon. J. Sterling Morton, whose able advocacy resulted in marvellous success from the first. The settler who now does not plant trees is the exception. The Nebraskans are justly proud of their great achievement in this line and are determined to maintain their pre-eminence.

Arbor Day in school is a child of the American Forestry Association, which eleven years ago adopted a resolution in favor of such an observance in all our schools, and appointed a committee to push that work. Its first efforts were not assuring. The indifference of governors and State school superintendents, who, at the outset, deemed Arbor Day an obtrusive innovation, was expected and occasioned no discouragement. Many State officials who at first were apathetic have on fuller information worked heartily for the success of Arbor Day. The progress of this movement has been remarkable. Arbor Day is now observed in forty States and Territories of the United States, and also in the Provinces of the Dominion of Canada, in certain districts of England, Australia, Japan, and South Africa. It has already become the most widely observed and useful of school holidays. Popular interest in this work has been greatly stimulated by the annual proclamations of governors and the circulars of school superintendents sent to every school in the State.

Arbor Day has fostered love of country, and has become a patriotic observance in those Southern States which have fixed its date on Washington's birthday. The custom of planting memorial trees in honor of Washington, Lincoln, Grant, Garfield, and other patriots and also of celebrated authors and philanthropists, has become general. Now that the national flag with its forty-four stars floats over all the school-houses in so many States, patriotism is effectively combined with the Arbor Day addresses, recitations, and songs. Who can estimate the educational influences, especially in regard to the beauty, utility, and growing value of trees and forests, exerted

upon the millions of youth who annually participate in these exercises? The public appreciation of trees and forests has been greatly increased by the many productions in prose and verse which the most eminent authors of America, like Holmes and Whittier, have written expressly for use on Arbor Day. What growth of mind and heart has come to myriads of our youth as they have pondered and recited or sung these rich gems of our literature, and, still better, applied them by planting and caring for trees.

Trees and tree culture are now the subjects of object-lessons in our best schools. Such lessons lead youth to study and admire our noble trees and realize that they are the grandest product of nature.

One of the educating forces of Arbor Day begins where children start little nurseries at home, plant tree seeds, acorns, nuts, and pits, and observe the wonderful miracles which the tree life is working out before them, transforming soil and inert matter into living forms of surpassing beauty and fragrance. The trees which children plant around the homestead and watch from seed will be increasingly prized as they grow into living memorials of happy youthful days.

Much as Arbor Day has done on limited school grounds, far greater improvements have been made on the homesteads and the roadsides. The work already accomplished will make thousands of roads attractive by trees. In many countries of Europe the road is lined with trees for hundreds of miles on a stretch. Growing on lands otherwise running to waste, such wayside trees yield satisfactory returns. The shade and beauty, grateful to every traveller, are doubly so to the planter, as thousands of farmers can testify. In tree-planting, the economic and ornamental touch at many points.

Will it pay the average farmer to plant trees? Certainly not, if early profits are essential. Future profit can be realized by planting trees in waste places on hillsides and in ravines too steep and rocky for cultivation, along the brook, and by the river-bank. Worn-out and exhausted plains have often been thus rendered of value.

In New England, and all the Atlantic States, there are large areas of barrens, worthless for field crops, that may be profitably devoted to wood-growing. Our Atlantic sand plains that were once covered with woods can be reforested. Over ten thousand acres on Cape Cod which thirty years ago were barren sand plains are now covered with planted forests. Hon. Joseph S. Fay's two hundred acres of fine forest at Woods Holl, Mass., and the three hundred acres of planted trees of H. G. Russell, of East Greenwich, R. I.,

both formerly barren sand plains, are genuine object-lessons for the Atlantic States. Attention should be called to the celebrated forest of Fontainebleau, in France, which covers an area of sixty-four square miles. The soil is composed almost entirely of sand. Jules Clare, an eminent student of forestry, says, "the sand here forming ninety-eight per cent. of the earth, it would be a drifting desert but for the trees growing and artificially propagated upon it."

The village-improvement movement was started nearly thirty years ago, and has spread across the continent. The chief object of the improvement societies is to make the environment of the home and the town healthful and attractive. The homes of our workingmen far surpass in comfort and taste those of the same classes in any other land. Improvement societies are helping in this grand result. Their influence has not been limited to the towns or counties where they have been organized, for the discussions they have prompted have benefited many towns where no improvement societies have yet been formed. The frequent editorials of the *New York Tribune* have been especially influential. Nearly twenty thousand copies of its village-improvement pamphlets have been circulated in response to orders received every week since its publication, less than three years ago.

These improvement societies often serve the same purposes as boards of trade in large cities, favoring good-fellowship and co-operation and the adoption of a non-partisan policy in local affairs. They foster a local pride and public spirit which invite liberal thoughts and generous gifts. They put to every citizen the question, "What do I owe to my town? What is my duty, or rather my privilege, to do for it?" Under such appeals, large gifts are made, not only by citizens but by natives now non-residents. Already many large gifts for parks, libraries, fountains, memorials—halls, schools, and other institutions—and prizes for the planting of roadside trees have come from them, often as pleasant surprises.

THE NECESSITY FOR STATE FORESTRY ASSOCIATIONS.

By B. S. HOXIE, Evansville, Wisconsin.

[Read at World's Fair Congress, October, 1893.]

It is now twelve years since the American Forestry Congress was called into existence—not for personal gain or aggrandizement, but out of purely benevolent motives. The men who conceived the idea of this association were persons of experience, men who had watched the onward march of civilization and the wanton destruction of most of our primeval forests. Many of them well knew that how to get rid of the timber and to fit the land for agricultural purposes was formerly the great desideratum. Indeed, within the memory of persons now present “logging bees” were scenes of no unusual occurrence. “Boys, we must clear the farm,” was the stirring cry. The heavily timbered country and the slow increase of our population in the early days made this the only method to subdue the earth. Except for the wants of settlers in limited areas, there was then no market for timber.

Lumbering forty and fifty years ago began to be an important industry in the Eastern and in the New England States. Maine, New Hampshire, and Pennsylvania were then the scenes of the greatest activity. But westward, ho! Later, Michigan, Wisconsin, and Minnesota, with their vast forests of pine, began to yield the wealth of timber. The older States have already ceased to yield a profitable supply of lumber to large companies. The rapid increase of our population, remote from the supply of building material, has made the lumber business one of our most important industries, until now it is estimated that the annual product of wood material of all sorts consumed in the United States may be valued in round numbers at \$1,000,000,000, representing about 25,000,000,000 cubic feet of wood, or the annual increase of the wood growth of 500,000,000 acres of forest. The products of our mines, the value of our wheat and other crops, are of minor importance compared to our timber resources. There are some who assert that in our country there never will be a lack of wood or timber, and by way of argument cite the rapid growth of young timber. It can be shown,

however, by carefully collected facts, that this supply is rapidly and constantly decreasing.

There is a misconception in the minds of many as to the work and aim of the Forestry Congress, or rather of the American Forestry Association, and in telling what its aims and objects are I will dwell upon the necessity for a State Forestry Association in each State in the Union. Its aim is to promote a more rational and conservative treatment of the forest resources of this continent and the extension of forest growth wherever for climatic or other reasons such seems desirable. It therefore invites owners of timber and wood lands especially to join its ranks for their own benefit. The Association has no desire to prevent the legitimate use of forest growth, but desires that it be so managed as to improve and increase its value.

The wanton destruction of woods and of forest material called this society into existence. Its founders considered that a sufficient supply of home-grown wood material was desirable in the household of a nation; that the forest cover on hillsides and mountain slopes had an important relation to water flow and to favorable soil conditions. It recognized the fact that climatic conditions were ameliorated by timber belts. Its members have shown that vast tracts of land otherwise worthless can be made sources of income to the State under forest culture.

Besides the American Forestry Congress there are in Pennsylvania, Ohio, Michigan, Minnesota, and other States local forestry associations, all having similar aims. Through organized efforts several States have lately passed laws having for their object the preservation of the timber of the public domain. Inducements have been given to private owners of timber lands to co-operate and act in harmony in reforesting waste and unproductive lands. Some of the owners of the largest tracts of timber lands in the State of Maine several years ago saw the necessity of preserving the forest growth. Stringent laws were passed by the legislature regarding fires, and the lumbermen and land-owners interested themselves in the enforcement of these laws. Some of these lands thus protected for twenty years or more are now yielding fair returns to the lumbermen. This is not, however, like the original growth of white pine, which took two hundred years to produce; for in many instances a hard-wood growth has taken the place of the pine of the primeval forest. There are, however, thousands of acres of second-growth pine in that State which is producing timber of good, fair quality for packing cases, and their manufacture is now quite an im-

portant industry in that State. This is an example of one of the results of organized effort.

The increase of the consumption of timber is out of proportion to the increase of its growth, but this need not be the case if by agitation by associations proper laws are enacted and enforced with regard to forest conservation; except perhaps in certain kinds of wood. Indiana, once heavily wooded, is now, like Ohio, largely denuded. It has taken less than fifty years to reduce the woodland area below twenty per cent. in that State. The valuable hard woods of Indiana, especially its oaks, hickories, and walnuts, were unequalled in quantity and size and have given rise to wood-working industries in the State which, in 1886, produced more than \$30,000,000 worth of manufactures. At present the walnut and poplar are practically gone; white oak is rapidly diminishing and growing poorer in quality, and the virgin growth is everywhere culled of its best timber. Over a half million acres of this are wasted lands only fit to grow timber.

It is a well-known fact that timber trees of the common white pine, which are at their best in our State, Wisconsin, are from 150 to 200 years old, and that this quality of timber is fast receding before the woodman's axe. The three great lumber States are now eating up their forests at a rate which will soon kill the goose that lays the golden eggs. Black walnut, so common twenty years ago, has become so scarce that the use of it has had to be discarded almost entirely for commercial purposes. The poplar or white wood is going the same way, and this, too, will soon become extinct, as it is found only in small areas of our country. It was only a few years ago that the lumbering interests of our State drew its supply from the vicinity of Green Bay and the middle portion of our State, but it is now mainly cut in the northern counties and at much greater expense than formerly.

The cutting down of the forests is not the worst feature, it is the utter neglect to preserve the forest floor so that other growths may take its place. Fires destroy the young growths and burn up the forest floor—the accumulation of ages—in many instances down to the sand or gravel bed, leaving the land bald and sterile for years before vegetation of any kind can exist. The facts mentioned for Wisconsin are true, in part, of every State. They form one great argument for the necessity of forestry associations. By such organizations the enlightenment of the public can be made possible. Trees planted in Nebraska, Kansas, and in Southern

Dakota ten and fifteen years ago, even as small farm plantations, are now yielding wood and small timber fit for domestic purposes, besides affording wind-breaks around farm buildings. Every farm in my own State or in any State where trees can grow should have a few acres of timber.

The public timber lands remaining ought not to be sold or otherwise disposed of, but should be placed under competent forest management. The community can afford to forego profit from such management in the present for the sake of insuring the future. State governments may secure and reserve for forest purposes such woodlands as exist or lapse for non-payment of taxes into their hands, and thus make a beginning for the future. Counties, towns, and smaller communities may for their self-protection reserve, as some land-owners in Massachusetts have begun to do, tracts of forest lands which eventually may also become immensely valuable in timber production. Such forest reserves will form the nucleus and beginning for the education of foresters and establishment of object-lessons in forestry.

Most urgent is the protection of forest property against fire. Aside from the indirect interest which the community has in maintaining desirable forest conditions, it is its fundamental duty to protect property, a duty that it unquestionably owes to the owners. Immediate action by associations of the people should bring such matters of public interest to the attention of the law-making power. One great aid at present is the interest awakened by Arbor Day exercises in our public schools. The children are learning to know about trees and forests and their value. With this lever in our hands, our State Forestry Association will work in harmony with other societies and the superintendent of schools to bring not only sentiment but facts to aid in the work of saving God's first temples.

THE AMERICAN FORESTRY ASSOCIATION—ITS AIMS AND ACCOMPLISHMENTS.

By HON. WARREN HIGLEY, of New York, N. Y.

[Read at World's Fair Congress, October, 1893.]

In popular governments great reforms can be wrought only through public sentiment. Agitation is the leaven, and combined

action the force, which, in a just cause, conquer error with truth, and firmly establish beneficent principles among mankind. In the realms of economics, no less than in the fields of philanthropy, victories are won through the devotion of a few enthusiastic and persistent leaders, with whom discouraging environments count for naught.

The annual utilized product of the forests of the United States is second only in value to that of agriculture. It exceeds, by a conservative estimate, one billion dollars; and this enormous consumption, increasing largely from year to year, far exceeds the forest increment. Therefore, the capital upon which this product depends is gradually disappearing, and under existing conditions must be swept away in the not very distant future.

When we consider, in this connection, the beneficent influences of forests upon civilization, the grounds for alarm are increased many-fold, and the warnings of the agitator have added significance. But widespread, counteracting influences have been actively at work the last two decades, educating the people and inspiring Congresses and legislatures toward forest protection and the establishment of systems of forest management adapted to the conditions and needs of our diversified country.

The American Forestry Association, organized and for seven years continued under the name of the American Forestry Congress, has accomplished more in the direction of arousing public interest and securing legislative enactments for the preservation and conservation of our forests than any other instrumentality. Its origin is unique, and forcibly illustrates how great reforms are instituted and afterwards carried on through the efforts of a few earnest workers.

Among the guests invited by the Government of the United States to participate in the centennial anniversary, in the autumn of 1881, of the surrender of Lord Cornwallis at Yorktown, Va., were Baron Richard Von Steuben, a distinguished Prussian forest official, and six officers of the Prussian Army, bearing the name of Von Steuben, representing the family of General Von Steuben of the American Revolution. After the celebration at Yorktown the Von Steubens were given a public reception at Cincinnati, Ohio, in which many of the prominent citizens of that place took part.

In a conversation between the forest official and Judge Warren Higley, one of the reception committee, and others, a discussion arose as to the rapidity with which our American forests were disappearing, and the prevailing lethargy of the people on the subject

of forestry, and a comparison was drawn with the systems of forestry practiced in Europe. The seed thus sown took root, and a conference, held at Judge Higley's office about the first of January following, at which Col. William L. DeBeck, a prominent newspaper correspondent, was present, resulted in the determination to hold a convention in that city for the promotion of forestry in America.

Under a call through the papers, a meeting was soon after held at the Gibson House, in which many prominent citizens took an active part, and organization was effected for the preliminary work of the proposed convention, with the following officers: President, Hon. John Simpkinson; Vice-Presidents, Hon. Wm. S. Groesbeck, Judge Alphonso Taft, Reuben R. Springer, Esq., Murat Halstead, Esq., Richard Smith, Esq., Ex-Governor J. D. Cox, Hon. Fred. Hassanrek, and Rev. Dr. I. W. Wiley, Bishop of the M. E. Church; Secretary, Col. Wm. L. DeBeck; Advisory Board, Judge Warren Higley, Judge J. W. Fitzgerald, Prof. John B. Peaslee, Supt. Public Schools; Ex-Governor E. F. Noyes, and the Rev. Dr. Max Lilienthal.

The Scientific Branch Committee consisted of: Chairman, Judge Warren Higley; Secretary, Alfred A. Springer, M. D.; Members, Dr. John A. Warder, Prof. F. W. Clarke, Prof. Adolph Leue, Prof. John B. Peaslee, and Rev. Dr. Max Lilienthal.

Weekly meetings were held through the winter, the proceedings of which were extensively published in the daily press. Under the impulse thus given, a county association was formed, which resulted in the adornment of private grounds and public highways in the various townships of the county by the planting of trees, and a widespread interest was aroused throughout the State and the country by the publication of these proceedings and articles pertinent to the subject of forestry.

A National Forestry Convention was appointed to be held at Cincinnati, to begin April 25, 1882, and continue five days. Invitations were sent out to persons interested in the subject of forestry throughout the United States and Canada, urging their attendance and co-operation; and the Governor of Ohio, being duly authorized by the legislature, appointed the 27th day of April, 1882, as Arbor Day, and recommended its observance throughout the State.

Pursuant to the previous arrangements of the local committee, the first session of the American Forestry Congress met in Springer Hall on the morning of the 25th of April, 1882. Distinguished representatives from the different States and the Canadas were present.

Ex-Governor E. F. Noyes was chosen temporary chairman, and the following gentlemen were appointed a committee on permanent organization: Dr. Franklin B. Hough, Dr. John A. Warder, Dr. Geo. B. Loring, Gen. C. C. Andrews, John H. McMacken, Esq., Hon. Warren Higley, Dr. John M. Walden, Prof. Wm. Saunders, Gen. Durbin Ward, and Dr. A. A. Springer.

A general meeting of the Congress was held in the evening, at which Gen. Durbin Ward, in the absence of the mayor of the city, welcomed the delegates and other strangers, and cordially extended the hospitalities of Cincinnati. He was followed by Gov. Charles Foster in an eloquent address of welcome on behalf of the State of Ohio. Other speeches followed. The committee on permanent organization reported a constitution, which was adopted, and the following officers were elected to serve during the ensuing year: President, George B. Loring, Salem, Mass.; Vice-Presidents, one from each State and Territory, and each province of Canada; Recording Secretary, W. L. DeBeck, Cincinnati, Ohio; Corresponding Secretary, D. D. Thompson, Cincinnati, Ohio; Treasurer, John A. Gano, Cincinnati, Ohio.

President Loring then delivered a carefully prepared and eloquent address, and this closed the first session. Thus was the American Forestry Congress organized and launched on its useful career. There were eighty-seven papers presented during the remaining four days of the Congress, the most important of which were published in the daily local papers and extensively copied throughout the country. Many of them were afterwards published in reports of Agricultural Societies, and especially by the Government of Canada in its horticultural report for the following year.

Arbor Day.

An important feature of this first meeting of the Congress was the celebration of Arbor Day, under the direction of the committee of arrangements. It had been decided to plant memorial trees in the principal parks of the city, with appropriate ceremonies. The principal celebration, however, was made in the new Eden Park, where had been previously located, under the direction of the noted landscape gardener, Adolph Strauch, the various groves to be planted, which were named and dedicated, "Pioneer's Grove," "Citizen's Memorial Grove," "Author's Grove," "President's Grove," etc.

Trees had been selected from various parts of the country and

from Europe and planted in the groves for which they were intended. "Author's Grove" embraced six acres, and was set apart for the planting of groups of memorial trees by the pupils of the public schools in honor of distinguished authors.

On the morning of April 27 the military, under command of Col. S. A. Whitfield, the school children, formed in companies of Forestry Cadets with their teachers, and a large number of citizens marched to Eden Park for the dedicatory ceremonies. Banners bearing in green the device of an oak leaf and the words "Welcome Foresters" were displayed by thousand—50,000 citizens covered the grassy slopes and crowning ridges to witness the novel scene. At the firing of the signal gun the various groves were planted and dedicated with loving hands and appropriate ceremonies. Then the multitude assembled around the grandstand and listened to speeches from ex-Governor E. F. Noyes, Hon. Cassius M. Clay, Gen. Durbin Ward, and Dr. Loring, then U. S. Commissioner of Agriculture.

I have dwelt thus fully upon this celebration of Ohio's first Arbor Day because this was the first public planting of memorial groves in America, if not in the world, in honor of statesmen, authors, soldiers, and distinguished citizens, and because from it a wide-spread influence and powerful sentiment went forth in favor of planting and caring for trees.

MONTREAL MEETING.

On the last day of the session it was agreed that the Congress should meet at the city of Montreal, Canada. Accordingly, on the 21st and 22d days of August, 1882, the second meeting of the American Forestry Congress was held at Montreal, Canada, and was eminently successful both as to the number in attendance and the work that was accomplished. These very desirable results were due to the energy and zeal of Mr. Wm. Little, Vice-President of the Congress for Canada.

It was there deemed advisable to amend the constitution, and Mr. B. E. Fernow, the present efficient Chief of the Forestry Division of the Department of Agriculture, as chairman of the committee, reported the amended constitution, which was adopted, and which in Article II defines the objects of the Association as follows:

"The objects of this Congress shall be the discussion of subjects relating to tree planting, to the conservation, management, and renewal of forests; the climatic and other influences

that affect their welfare; the collection of forest statistics, and the advancement of educational, legislative, or other measures tending to the promotion of these objects. It shall especially endeavor to centralize the work done and diffuse the knowledge gained."

WHAT HAS THE ASSOCIATION ACCOMPLISHED?

Recognizing the great educational force exerted through the observance of Arbor Day by the public schools and citizens of the country, the Association has labored persistently through its Arbor Day committee, of which the Hon. B. G. Northrup has been the chairman from the first, to secure its permanent adoption by the several States and Territories. The zeal with which the committee has pursued this object is evidenced by the fact that Arbor Day is now celebrated in 45 States.

Up to the time the American Forestry Congress was organized, tree planting had been encouraged only by the authorities of some of the prairie States for economic purposes. The legislatures of Minnesota, 1871, and Illinois, 1874, offered a bounty; Iowa, 1872, exemption from taxes; Dakota, 1877, bounty and exemption from tax; Nebraska, in 1872, through its State Board of Agriculture, inspired the planting of millions of forest trees on the appointed day. This action was taken at the instance of Lieut. Governor J. Sterling Morton, and was following a patriotic proclamation of the then Governor R. W. Furnas, the first Arbor Day proclamation issued by the governor of a State. The impetus thus given has continued, until to-day many hundreds of thousands of acres in Nebraska are covered with waving forests. Other prairie States followed the example of Nebraska with similar results. Immediate necessity was the moving cause, and the benefits to those States are incalculable.

The Cincinnati plan introduced the celebration of Arbor Day into the schools, and inculcated a widespread sentiment through the planting of memorial trees and groves, which has led to the education of the people in the subject of forestry, given increased interest in tree growth and forest preservation, and prompted legislators to consider and, in some instances, to enact laws in the interest of forestry. There are now twenty-eight States and Territories in the United States that have a legally-established Arbor Day, and in six of these the day is a legal holiday. The time, we trust, is not far distant when it shall be a national holiday.

The Association has endeavored from the first, and in a large

measure succeeded, in interesting in its work representative men and women. Many of the legislatures of the States and the Government of Canada have sent delegates of their most distinguished citizens to attend its annual meetings and take part in the deliberations, and the Agricultural Department of the United States has taken a very active interest in the work of the Congress from the very beginning. It was recognized as the popular sustaining force for the promotion of the work in the Forestry Division—the avenue through which legislation could best be secured.

For several years the particular subjects for discussion were chosen with a view to most benefit the section of country within which the annual meeting was held. The results generally proved most gratifying. By way of illustration I refer to the annual meeting of the Congress held at Boston, September 22d, 23d, and 24th, 1885, under the auspices of the Massachusetts Horticultural Society. Its work was planned and programs arranged with special reference to the forest conditions and needs of New England.

California and Nebraska, as well as the Canadas and the nearer States, sent delegates of their most distinguished citizens to this meeting. The General Government was represented by the Commissioner of Agriculture. The papers, discussions, and proceedings of the sessions were published generally in the leading papers of New England, and afterwards many of them were published in the agricultural journals of that section, as well as in a special volume of Proceedings.

The following committee was appointed on New England Forest Policy: Gen. Chas. Hamlin and John E. Hobbs, of Maine; Wm. S. Ladd and Geo. B. Walker, of New Hampshire; Francis H. Appleton and Wm. C. Strong, of Massachusetts; Henry G. Russell and Chas. W. Smith, of Rhode Island; T. S. Gold and B. G. Northrup, of Connecticut; Redfield Proctor and Hiram Cutting, of Vermont.

New England was awakened as she had never been before to the importance of protecting and conserving her forests. Within two years her six States established, and have ever since celebrated, Arbor Day after the Cincinnati plan. Other valuable and pertinent legislation in the interest of forestry may be claimed as directly or indirectly the result of the interest incited by this meeting at Boston.

In no direction, however, has the work of the Association been pursued with more directness and persistence than in trying to influence the National Congress to pass laws deemed necessary to the protection and management of the national forest domain.

Petitions and resolutions were presented to both branches of our National Legislature, and laws were formulated and pressed for passage by the committee on legislation year after year without any decided success, and yet not without encouragement from Senators and Congressmen.

Soon after the meeting of the Forestry Congress at Atlanta, Ga., in the early winter of 1889, a committee, appointed for the purpose, waited upon President Harrison and presented a memorial urging the adoption of an efficient Government policy for the preservation and protection of the public forests, and urging the President to call the attention of Congress to the subject with favorable recommendations. The President graciously complied with this request. In October following, at the annual meeting of the Forestry Congress, held at Philadelphia, a petition to Congress was adopted, urging the enactment of a law withdrawing from sale all forest lands belonging to the nation, and committing them to the custody of the army, until a commission should determine what portions of them ought to be kept permanently in forests for the public welfare. The following year, 1890, Congress passed a law empowering the President to establish by public proclamation such reservations of forest domain as, upon recommendation by the Secretary of the Interior, he might deem necessary to the public welfare. The area of the permanent forest reservations, proclaimed under this law by President Harrison, aggregated nearly 13,000,000 acres, and lately President Cleveland added to them nearly 5,000,000 acres more.

There is a bill now pending before Congress which the American Forestry Association suggested and has strongly advocated providing for a practical system of forest management for these Government Forest Reservations and it is confidently hoped that Congress will, in the near future, give adequate legislation putting into effect a sound, practical, forest policy for the wise management of all our national forest domain, now estimated at about 50,000,000 acres. To this end has the Forestry Association long been striving, and we feel that we can now look forward with confidence to its accomplishment in the not very distant future.

Prof. B. E. Fernow, Chief of the Forestry Division, U. S. Department of Agriculture, in his report for 1892, says: "We may, then, before the end of the century, expect to see the first phase of the history of forestry development in the United States ended, by having the Government fully committed to a sound forest policy.

Such a policy will induce imitation on the part of smaller communities, and finally of private landlords, especially as with the settlement of the country greater stability will lead to permanent investments and induce conservative management, when also with the rapid destruction of virgin supplies the profitableness of forest management will have become more apparent."

The influence of the American Forestry Congress (changed to "Association" in 1889) is also apparent in the forestry legislation of many of the States, in the direction of establishing great forest preserves or parks, of such portions of their domain as are deemed necessary to the water supply and climatic conditions, and placing them under the management of State Forest Commissions.

New York has outlined a State Park in the Adirondack mountains which embraces about three million acres. Of this the State owns about 600,000 acres, and purposes to own or control the balance, to the end that this vast area shall be forever devoted to forest preservation. The State owns also about 400,000 acres in other parts of the State, including the Catskill Forest Reserve, which have been under the care and protection of the State Forest Commission. The first steps have thus been taken toward the establishment of a practical system of forest management, on a large scale, which shall not only preserve the forest covering over the great watersheds of New York, but will yield a generous supply of wood product for the economic uses of the people, through all time. Other States are preparing to follow the example of New York, notably among these are New Hampshire and Pennsylvania. This work will probably go on until every State in the Union shall have its Forest Reserves under practical forest management. Private interests also have been stimulated and local forestry associations formed throughout the country, while the parent association has grown in strength and influence, and in this centennial year promises to enter upon a still more successful career.

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Schlich's Manual of Forestry. 2 vols. Bradbury, Agnew & Co. 1889.

Nisbet's Studies in Forestry. Oxford, 1894.

These two works are technical in character, devoted to silviculture. The authors are both recognized authorities.

Apgar, Trees of the Northern United States. American Book Co. New York, 1892. \$1.00. A manual for determining the names of trees.

Houston's Outlines of Forestry. J. B. Lippincott & Co. Philadelphia, 1893. \$1.00. A popular statement of general questions.

"What is Forestry?" Bulletin 5 of the Division of Forestry, U. S. Department of Agriculture. Outlines the principles underlying forest management.

"Forest Influences." Bulletin 7 of the Division of Forestry, U. S. Department of Agriculture. A complete hand-book on the influence of forests on climate and water-flow.

Forestry for Farmers. Extract from Yearbook of the Department of Agriculture for 1894. Brief chapters on How trees grow ; How to treat the wood lot ; How to grow a wood crop ; How to improve the crop.

Annual Reports of the Chief of the Forestry Division for 1892 and 1893. These reports contain brief summaries of the condition of the forests and the forestry movement in the United States ; also a condensed statement of German forestry methods.

The last three publications can be obtained by application to the Division of Forestry, U. S. Department of Agriculture.

Proceedings of the American Forestry Association :—

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